METAL FINISHING

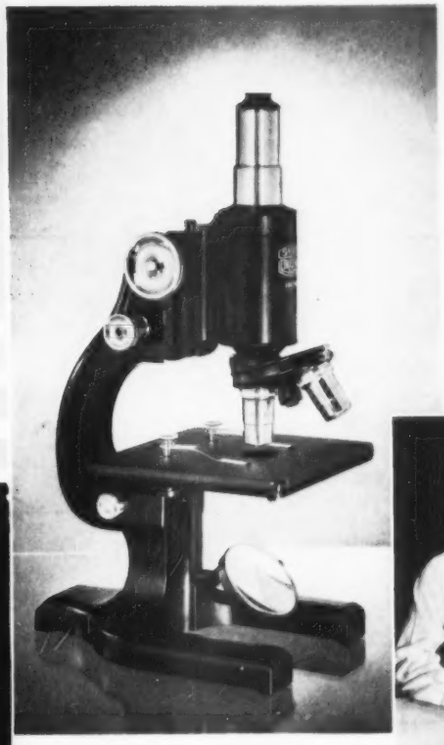
PREPARATION, ELECTROPLATING, COATING

PUBLISHED FOR THIRTY-SEVEN YEARS AS METAL INDUSTRY

Dec. 30

COPYRIGHT DEPOSIT.

THE LIBRARY OF CONGRESS SERIAL RECORD
APR 12 1943
Copy 1



LEA

BURRING
POLISHING
BUFFING

help to produce these fine

SPENCER MICROSCOPES

Operations in the Spencer Lens Company's plant in Buffalo on which LEA Method and Materials are used in helping to produce Spencer Microscopes, include the following:

Purring	Rough finishing
Removing solder	Final finishing
Cleaning	Buffing

For example, the body tube of the microscope illustrated is finished with LEA Materials before being enameled. The bright parts are mostly diamond turned, plated and then buffed.

Whatever your product—for war purposes—or for peaceful pursuits—if it has a burring or finishing operation, write us about it. In all probability, the LEA Method with properly selected LEA Materials will enable you to turn out a better product at lower cost.

THE LEA MANUFACTURING CO.

WATERBURY, CONN.

Burring, Buffing and Polishing . . . Specialists in the Development of Production Methods and Compositions

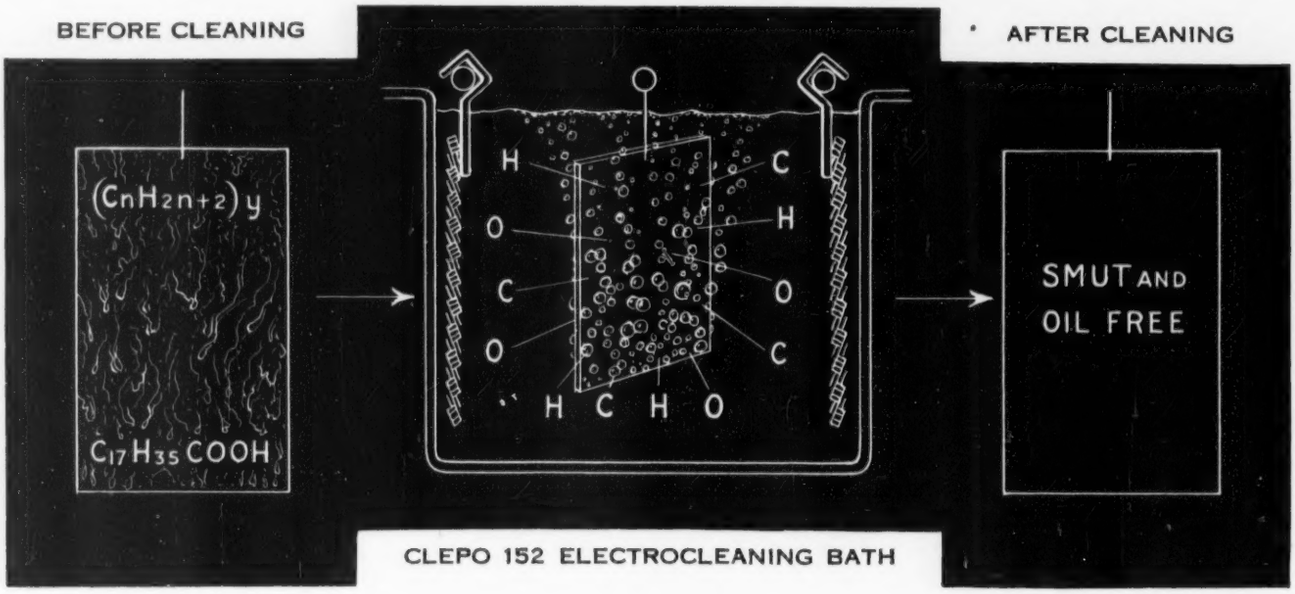
4 LM 3

APRIL, 1943—41st YEAR

CLEPO 152

ELECTRO-ATOMIZES ★

OILS, GREASES, DRAWING COMPOUNDS AND CARBONACEOUS MATTER . . . . .



CLEPO 152 ELECTROCLEANING BATH

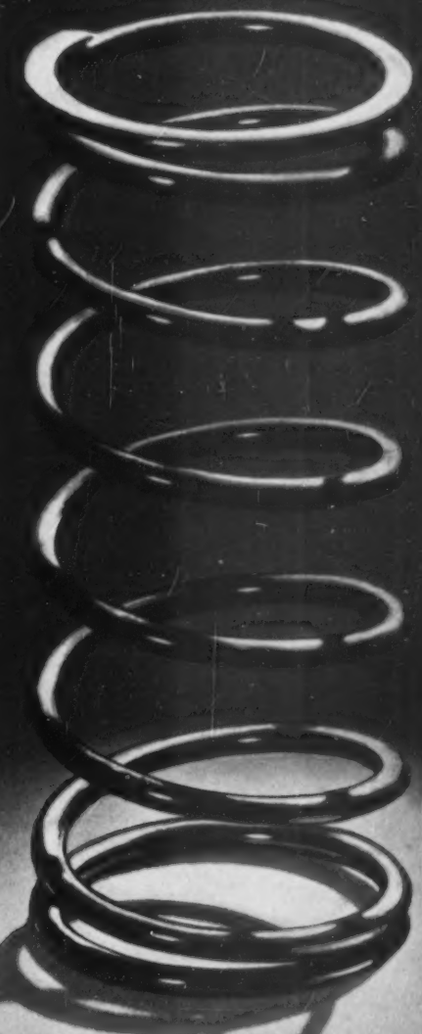
★ CLEPO 152 does not saponify or emulsify. It molecularly disintegrates and disperses all oil, greases, drawing compounds and carbonaceous matter. These microscopically small particles rinse very freely from the work being cleaned.

Electro-Atomized cleaning with CLEPO 152 is the perfect method of metal preparation for ferrous metals prior to ZINC, CADMIUM, COPPER, CHROMIUM AND LEAD PLATING. It guarantees MINIMUM POROSITY of electrodeposits due to complete removal of foreign matter from the base metal.

FREDERICK GUMM CHEMICAL CO.
• INC. •
538-542 FOREST STREET • KEARNY, N. J.

APR 12 1943

Spring Life



DEPENDS UPON CORROSION PROTECTION WITHOUT HYDROGEN EMBRITTLEMENT

Upon just such springs as this depends the success of a machine of war. The life of this spring, in turn, is protected and lengthened by treatment with Ebonol "S".

Ebonol "S" is being used on a host of war products — ball bearings, pinions, gears, guns, bombs, propellers, etc., because the finish is hard, adherent, tough, wear resisting, friction reducing, corrosion protecting and black.

The Ebonol "S" process is selected because it is simple to control and operate, economical, and the most pleasant blackening process to operate.

Enthone engineers are college trained chemists and metallurgists with years of practical plant experience to serve you better.

IT'S EBONOL-IZED

Other Blackening Processes for War Plant Needs

Ebonol "C" for Copper, Brass and Bronze
Ebonol "Z" for Zinc Plate and Zinc Alloys
Ebonol "A" for Aluminum and its Alloys

THE ENTHONE CO NEW HAVEN CONNECTICUT

Chicago	*Detroit*	*Newark*	*New York*
GEORGE A. STUTZ MFG. CO.	FREDERIC B. STEVENS, INC.	THE PLATING PRODUCTS CO.	SPECIAL CHEMICALS CO.
1641 Carroll Ave.	Larned & 3rd Sts.	352 Mulberry St.	30 Irving Place
Chicago	Detroit	Newark, N. J.	New York

METAL FINISHING is Published monthly by The Metal Industry Publishing Company, 11 West 42nd Street, New York, N. Y., U. S. A. Entered as second class matter February 25, 1903, at the Post Office in New York under the Act of March 3, 1879. Volume 41, Number 4, April, 1943. Two Dollars Per Year.

OAKITE Composition No. 90 is a NEW, wartime material specifically designed to meet NEW, wartime requirements in anodic degreasing or REVERSE CURRENT cleaning of cold rolled steel parts before electroplating, the Bullard-Dunn Process or other finishing operation.

Subjected to long and exacting tests, this specialized, basically different material is proving a dependable, economical answer to the problem of turning out the increased volume that today's faster cleaning cycles demand. In plant after plant across the Nation, plating department superintendents and foremen platers have found this remarkable Oakite development provides a sure, successful way to speed-up production of airplane, tank, gun, ammunition and communication equipment parts.

GIVES YOU THESE 6 MAJOR ADVANTAGES:

1. *SPEEDIER* removal of smut, oil, grease, buffing and drawing compounds, etc.
2. *FASTER* wetting-out action
3. *MINIMIZES* and controls foaming in automatic cleaning and plating equipment
4. *SPECIAL* emulsifying properties that speed-up degreasing action and provide greater mineral oil tolerance
5. *LONGER* solution life . . . contributes to lower unit costs
6. *MORE UNIFORM* results that help you keep production moving along smoothly on schedule

How can Oakite Composition No. 90 be applied to YOUR work? How can it be used to speed production of essential war supplies you are making? Let us give you the answers! Write today . . . COMPLETE information yours FREE for the asking!

Manufactured only by

OAKITE PRODUCTS, INC., 18 Thames Street, NEW YORK, N. Y.

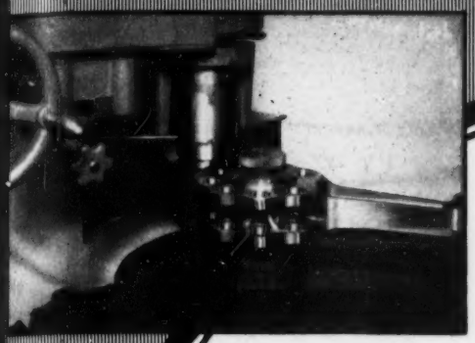
Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE MATERIALS...METHODS...SERVICE

CLEANING FOR EVERY CLEANING REQUIREMENT

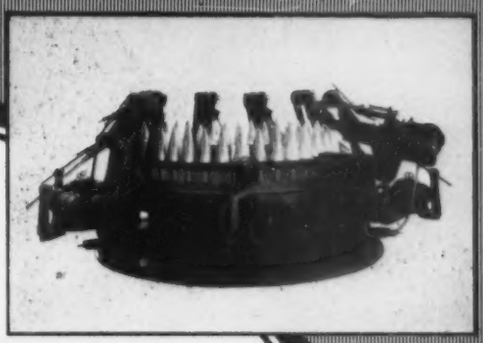
Solving the Man-Power Shortage

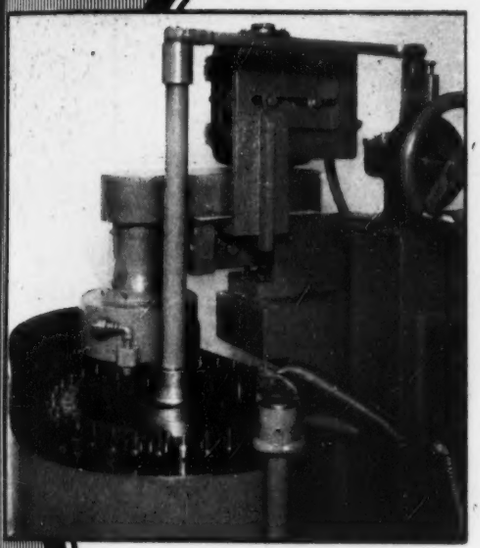
in POLISHING..BUFFING..
WIRE BRUSHING..BURRING



Special Acme Machine for polishing engine parts.

Special Acme Machine with 8 belt heads — for polishing tapered cylindrical parts. Multiplies daily production, with greatly reduced man-power.



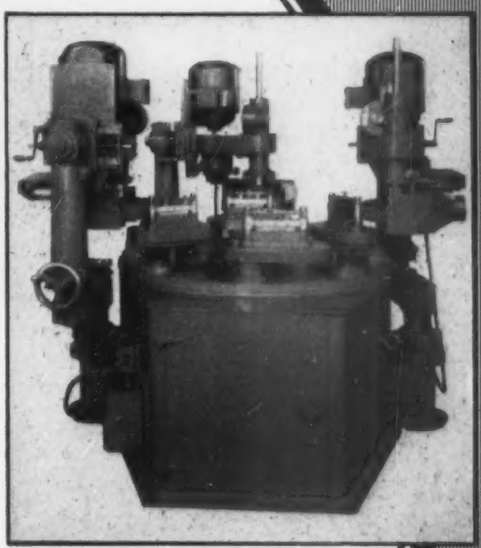


Keep Production Up

BY USING

ACME AUTOMATICS

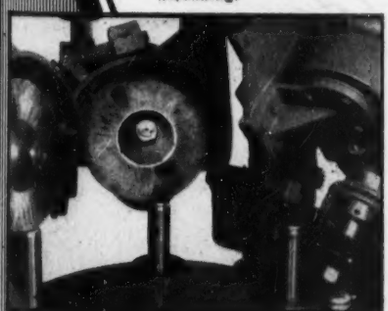
And Spreading Your Man-Power!



Special Acme Machine for grinding small mechanical parts—2000 per hour. Automatic wheel feed. Automatic diamond dresser. Automatic unloading.

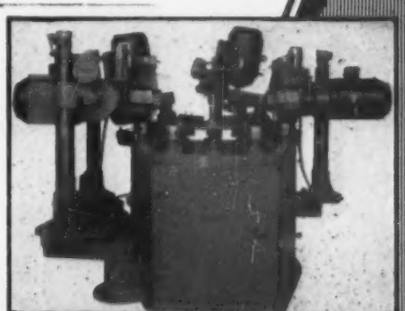
Special Acme Machine for blending the radius in washers—1200 to 1500 operations per hour.

Special Acme Machine for polishing and oiling aircraft parts.



Acme Rotary Machine for polishing, buffing and wire-brushing. Big savings in man hours.

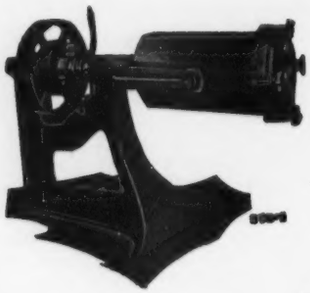
Special Acme Machine for finishing pistons. Constructed to finish valve recess and avoid sluff marks.

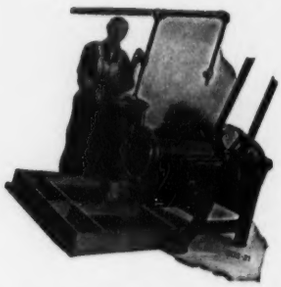


ACME *Manufacturing Co.*

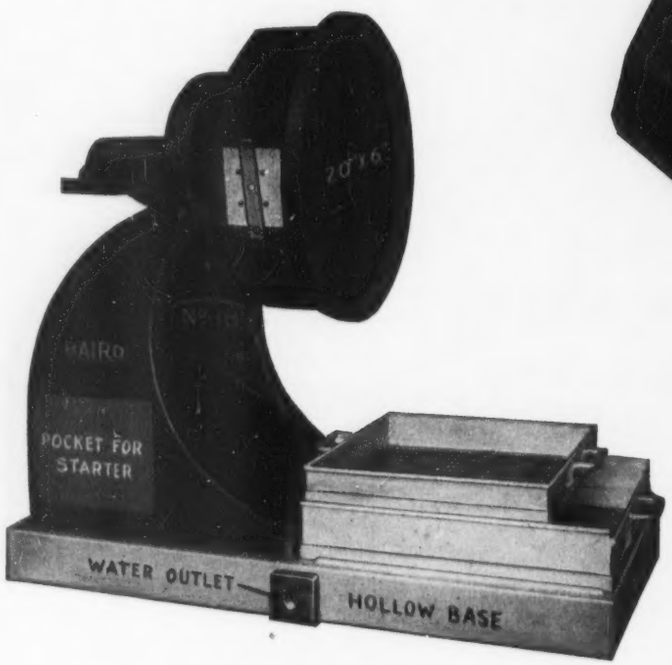
1642 HOWARD ST. • DETROIT, MICH.

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 25 YEARS





HORIZONTAL BARRELS **TILTING BALL BURNISHING BARRELS**



This shows a High and Narrow Type of Barrel mounted on "Baird" Model D. or Pedestal Type Motor driven Oblique Tilting Tumbler.

As shown the barrel was lined for use for burnishing with hardened steel balls.

These barrels may be of any suitable material depending on the job. Cast iron or fabricated steel unlined or lined with rubber etc. for rolling in abrasives.

Made in 20" dia. x 6" for No. 1 Tumbler
Made in 24" dia. x 8" for No. 2 Tumbler

This shows the side of a No. 1 BAIRD Model D. Single Oblique Tilting Tumbler with a No. 22 Sheet Steel Polygonal Barrel and with an Automatic Electrical Tilting Device.

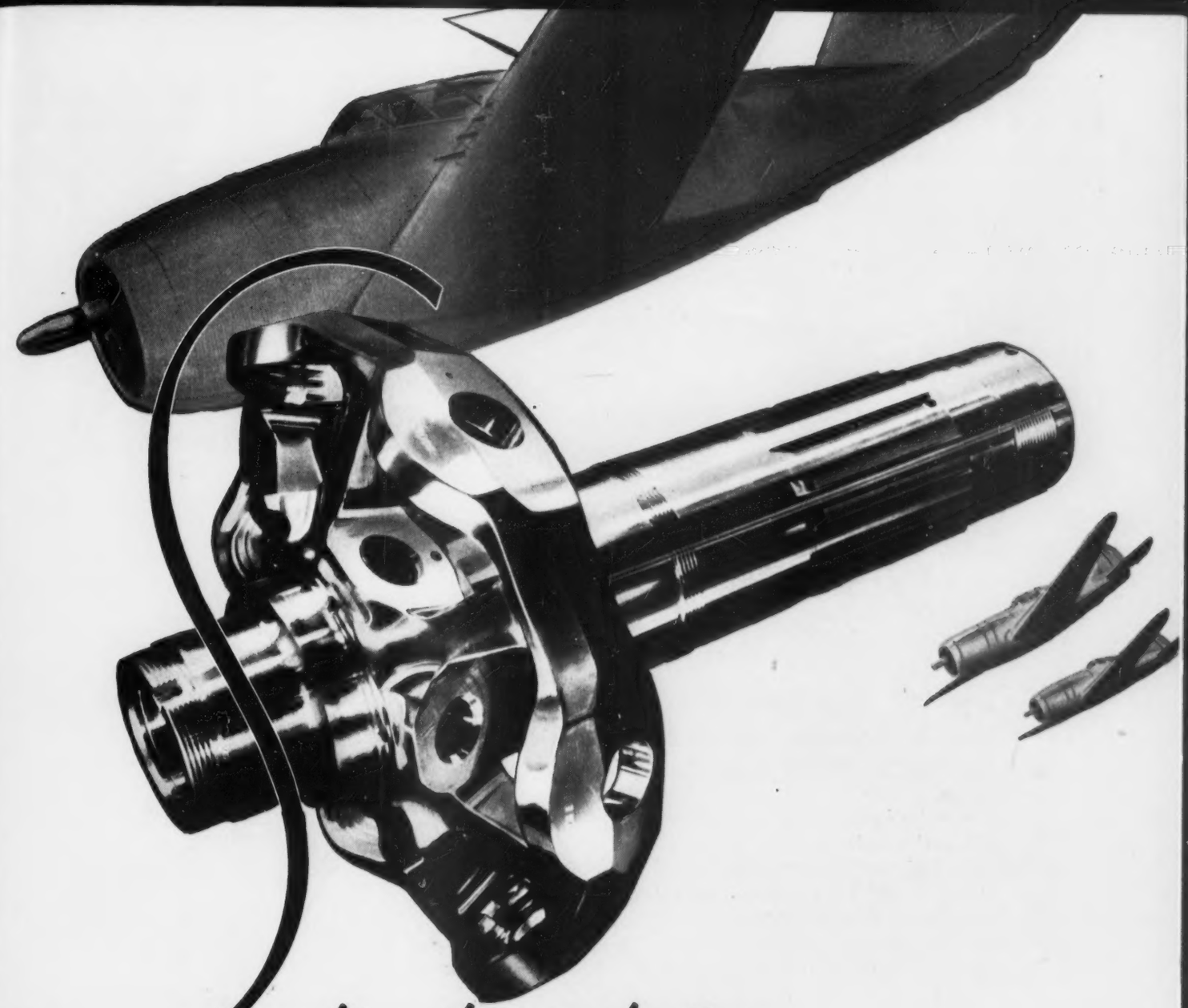
This device AFFORDS GREATEST SAFETY—LEAST LABOR—LEAST FLOOR SPACE—LEAST AMOUNT OF DISTANCE TO MOVE WORK in USING the tumbling barrels. SAVES TIME AND FLOOR SPACE.

When tumbling questions come up "ASK BAIRD ABOUT IT"

THE BAIRD MACHINE COMPANY

BRIDGEPORT, CONNECTICUT

Since 1846 specializing in high production machinery for articles of wire and for ribbon metal. Also machines to turn, bore, etc., castings, forgings, etc., up to 10½" diameter.



Speeding the production of a famous aircraft engine

WITH PENNSALT CLEANER

A leading automobile manufacturer now making Pratt & Whitney aircraft engines had done a remarkable job of mechanical production . . . and was interested in stepping up the efficiency of the metal cleaning (chemical) operations.

A wide variety of steel and brass engine parts—including the polished steel propeller shaft illustrated—had to be cleaned of mineral cutting oil, black emery, or tallow polishing compound, prior to tin or cadmium plating . . . All work went through a solvent degreasing operation. Electro-cleaning, with two kinds of cleaners, was carried on in two crane operated tanks, with both direct and reverse current. But even with this cycle, cleaning of polishing compound was not complete.

A Penn Salt technical representative was able to do a real job of improving this method. He eliminated the solvent degreaser—and with the same Pennsalt Cleaner in each tank, he used it as both a soak-cleaner and electro-cleaner.

The resulting work was excellent. There were no rejects. The finish was judged to be the brightest ever obtained. Moreover, everybody in the plating room welcomed the elimination of the costly solvent degreasing operation.

What's *your* metal cleaning problem? Whatever the kind of metal or the type of material to be removed, you can benefit by the experienced advice of a Penn Salt technician. Let him tell you what the family of Pennsalt Cleaners is doing throughout industry today to save time, materials and labor. If you prefer, write fully to our Pennsalt Cleaner Division, Dept. MF.

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals
1000 WIDENER BUILDING, PHILADELPHIA, PA.
New York • Chicago • St. Louis • Pittsburgh • Wyandotte • Tacoma

". . . . . experiments indicate that the new (Beckman) high-alkaline type glass electrode is the first practical and accurate method for pH control of cyanide plating baths."

Gray—Proc. Am. Electroplaters' Soc.

BETTER DEPOSITS AT HIGHER PLATING SPEEDS with *Beckman* pH CONTROL!

Type "E" Glass Electrode Equipment Ideal for Cadmium, Copper, Zinc, Brass and Similar Plating Operations

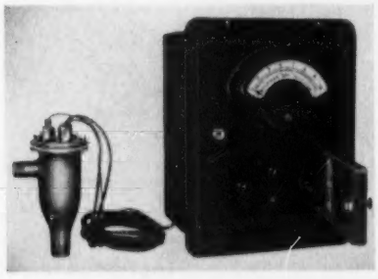
With today's urgent need for higher speeds, greater efficiencies, reduced losses in ALL plating operations, Beckman pH Control is a "must" for modern plating plants. For Beckman is the *only* pH equipment that is equally efficient in all plating baths, acid or alkaline, *regardless of color, turbidity, organic substances, or oxidizing and reducing agents!*

And Beckman is the only modern pH equipment providing glass electrodes that can be used in highly alkaline solutions, *even in the presence of sodium ions.* This Beckman development is an invaluable aid to such plating operations as cadmium, copper, zinc, brass (both rubber-adhesion and straight brass plating) and similar plating operations. By using it you can obtain better deposits—at higher plating speeds—with fewer rejects!

Write our engineering department for further information and descriptive literature!

BECKMAN INSTRUMENTS DIVISION
NATIONAL TECHNICAL LABORATORIES
South Pasadena • California

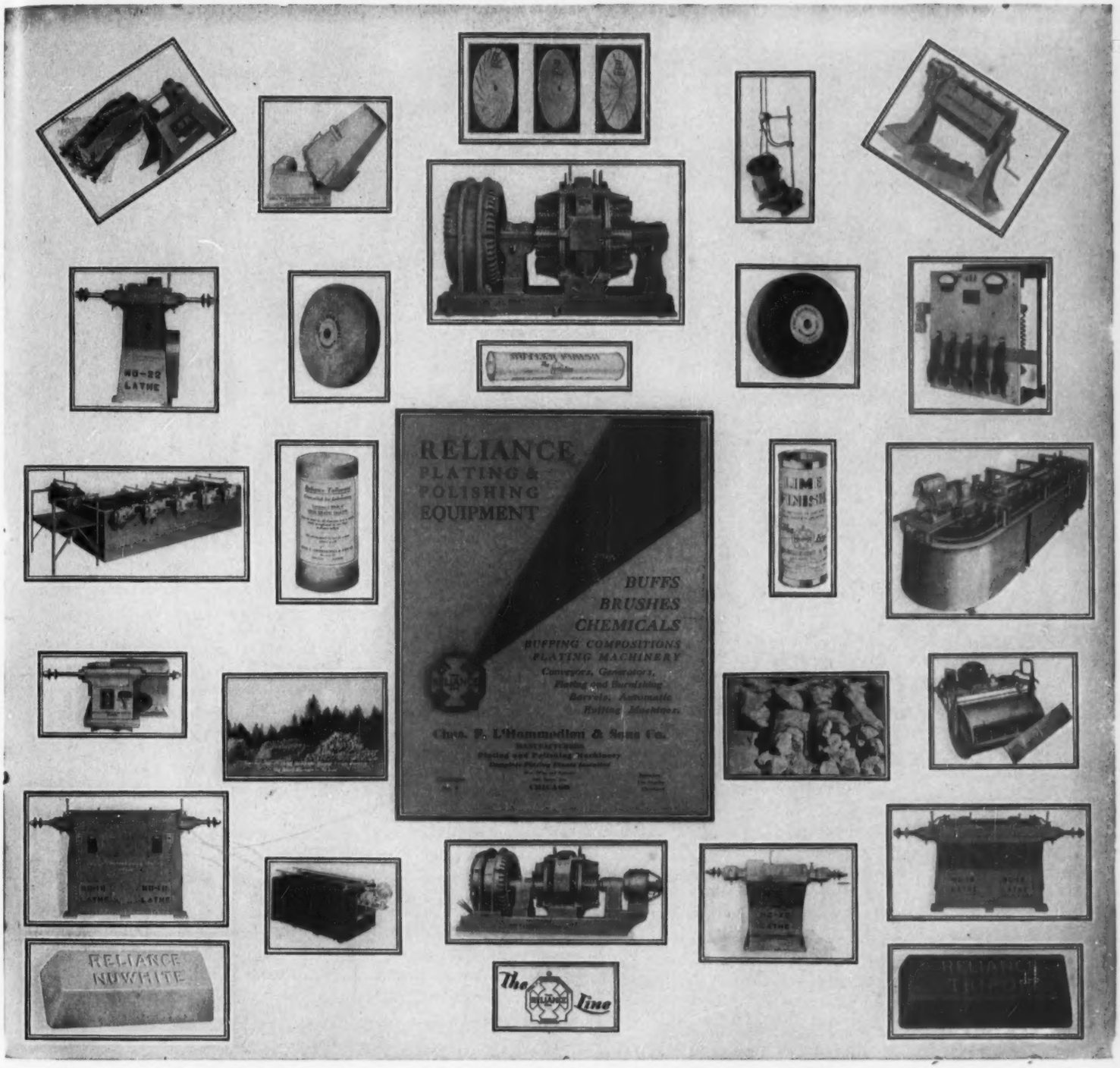
The Beckman Industrial pH Meter—ideal for portable plant and field use. It combines laboratory accuracy with a ruggedness and a simplicity of operation that permit quick, accurate pH measurements on all types of plating baths by even inexperienced help. *Write for Bulletin 21!*



The Beckman Automatic pH Indicator—the most advanced instrument available today. Continuously indicates pH fluctuations and can also be equipped to provide a written record and completely automatic pH control. Ideal for maximum efficency in large-scale plating operations. *Write for Bulletin 16!*

Beckman THE LEADING NAME IN pH

PLATING & POLISHING EQUIPMENT



Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Installed

C. B. Little
Newark, N. J.

W. R. Shields
Detroit, Mich.

O. M. Shoe
Philadelphia, Pa.

Gen. Office and Factory:
4521 Ogden Ave.

CHICAGO

Branches:
Cleveland
and
Los Angeles

DARCO *Halts the Dirty Work of Plating Solution* SABOTEURS

Darco activated carbon never sleeps on the job of *adsorbing* impurities that can ruin good plating . . . grease, soap, oil, decomposition products and colloidal impurities.

Ordinary periodic filtration may guard against readily visible suspended matter. But continuous filtration, with Darco S-51, stops the insidious *traces* of impurities from causing trouble. Darco catches and removes them from the solution before they can spread on the plating surface.

Many of the country's important plants are filtering continuously with Darco S-51 with complete success—even with today's heavy schedules. Continuous purification permits much smaller dosages, because impurities are not allowed to build up.

Add Darco to your filter. Ten cents buys enough to keep 100 gallons of solution clean for a week. Insist on the trademarked package and specify Darco.

The article, "Physical Removal of Impurities from Plating Solutions," discusses continuous filtration in detail. Write for a copy.

DARCO—Reg. U. S. Pat. Off.

DARCO

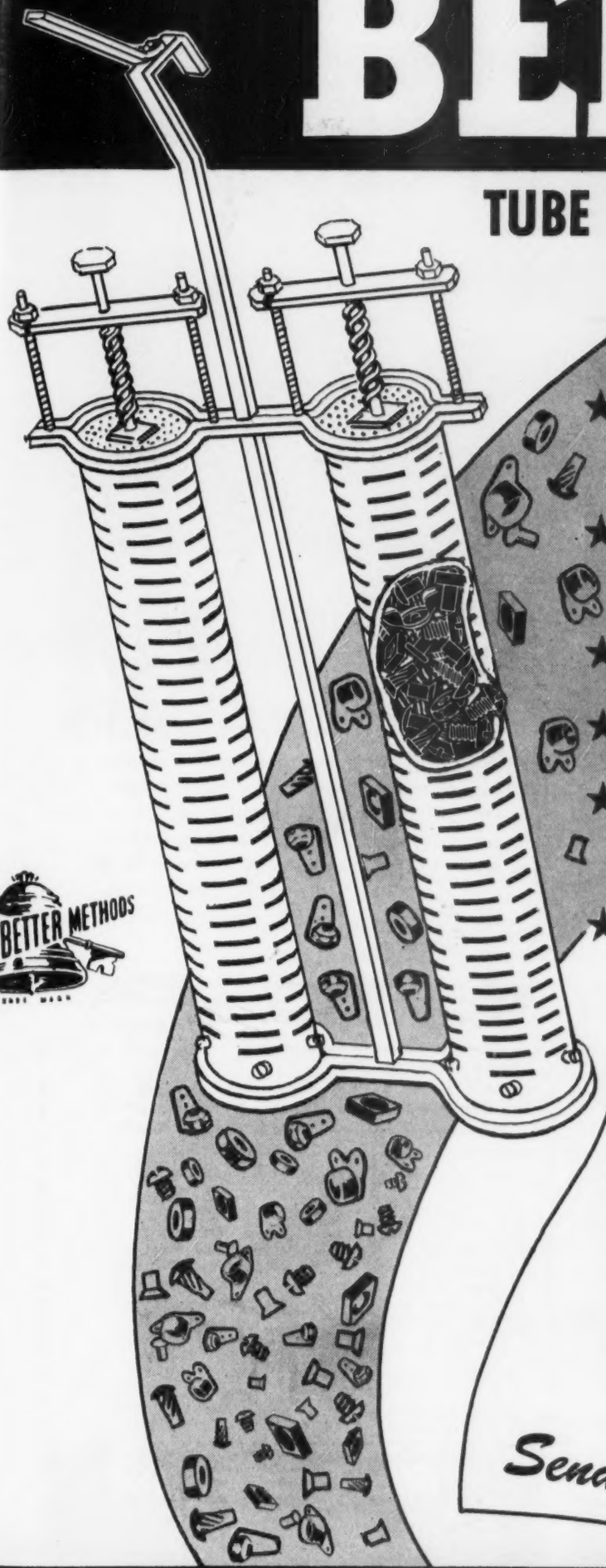
This trade-mark identifies the genuine. Accept no packages without it.

DARCO

CORPORATION

60 East 42nd Street, New York, N. Y.

BELKE'S



TUBE DESIGN ANODIZING RACK FOR SMALL PARTS

Increase Production

- ★ STRONGLY RECOMMENDED FOR ANODIZING SMALL AIRCRAFT PARTS
- ★ 2 LARGE CAPACITY ALUMINUM TUBES DESIGNED to CONSERVE SPACE
- ★ SPRING TENSION
- ★ EASY TO LOAD AND EMPTY
- ★ WELL PERFORATED FOR HEAT DISPERSION
- ★ CONSTRUCTED OF 17 or 24-ST. ALUMINUM THROUGHOUT

QUICK DELIVERY

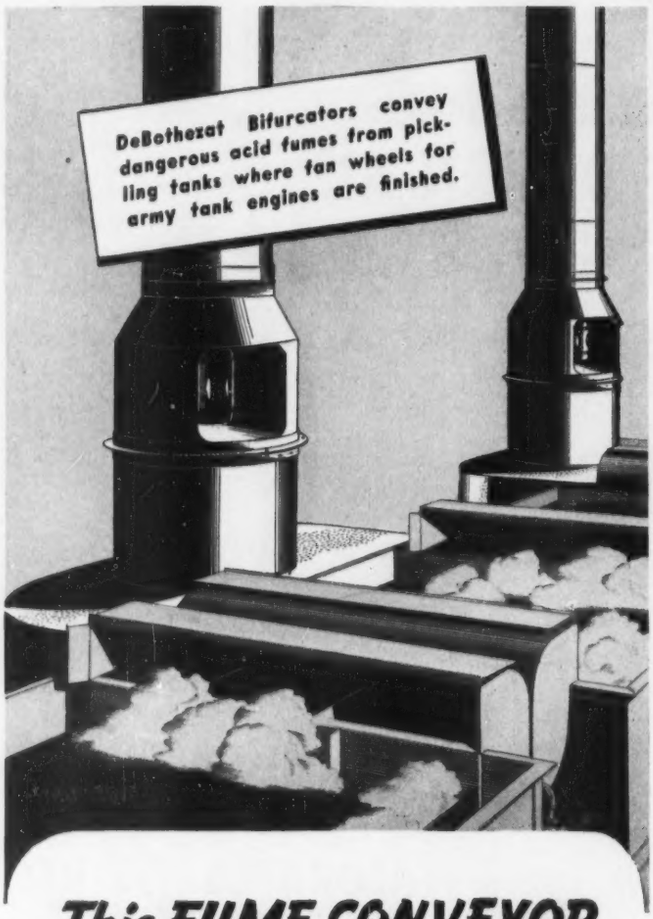
BELKE'S BETTER METHODS

BELKE'S NEW SALT SPRAY MACHINE

Send for LITERATURE *Today*

BELKE MFG. CO.

947 N. CICERO AVE., CHICAGO


DeBothezat Bifurcators convey dangerous acid fumes from pickling tanks where fan wheels for army tank engines are finished.

This FUME CONVEYOR INSTALLS IN THE DUCT

YOU CAN INSTALL DeBothezat Bifurcators in any position from horizontal to vertical . . . and *right in the duct!* This feature *eliminates* elbows, bends and supporting platforms. Bifurcators are supported like any length of ordinary duct work. Extreme flexibility makes installation simple and inexpensive.

MOTOR ISOLATED FROM FUMES in a through-ventilated chamber. Motor is easily accessible for inspection and servicing.

MOTOR PROTECTED against burning out by non-overloading power characteristic of the DeBothezat Axial-Flow fan.

SIZES of Bifurcators range from 18" to 48" in a wide range of capacities.

ARMY E NAVY

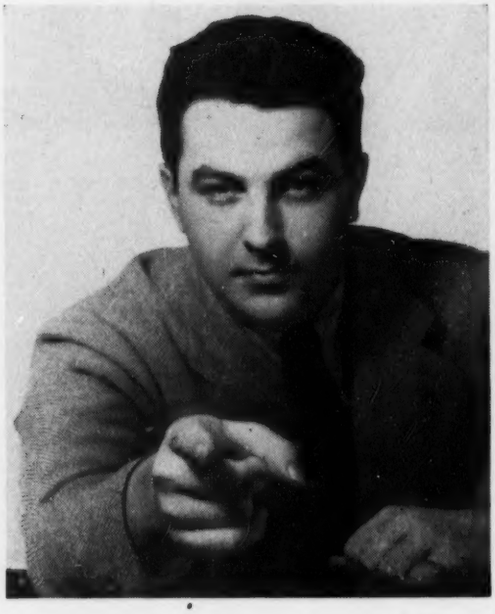
Send for interesting FREE Bifurcator Book

De Bothezat

VENTILATING EQUIPMENT

Division of

AMERICAN MACHINE AND METALS, INC., EAST MOLINE, ILLINOIS



Is Your Department a BOTTLENECK?

If your department is falling behind in the production schedule; if you have a problem of desoiling, degreasing, decarbonizing, surface preparation, or maintenance, there is a proven Turco Industrial Chemical Compound which will help you speed up and break that *bottleneck*. Want ideas and shortcuts? Write us for free information. Check and mail the coupon below. No obligation.

27-43

SPECIALIZED INDUSTRIAL CHEMICAL COMPOUNDS

TURCO

TURCO PRODUCTS, INC.
6135 S. Central, Los Angeles

Please send FREE literature on materials, methods and procedure pertaining to the operations checked below:

NAME_____ TITLE_____

FIRM _____

ADDRESS_____ STATE_____

- ☐ Acid Pickling
- ☐ Aluminum Spot Welding
- ☐ Anodizing
- ☐ Cadmium Plating
- ☐ Chemical Vapor Cleaning
- ☐ Chromatizing
- ☐ Cleaning Metals Before Processing
- ☐ Cleaning Prior to Plating
- ☐ Cold Immersion Cleaning
- ☐ Cold Spray Cleaning
- ☐ Floor Maintenance
- ☐ Glass Cleaning
- ☐ General Plant Maintenance
- ☐ Hot Immersion Cleaning
- ☐ Magnesium Processing
- ☐ Paint Camouflage Cleaning
- ☐ Paint Department Maintenance
- ☐ Paint Stripping
- ☐ Phosphatizing
- ☐ Scale Removal and Control
- ☐ Stainless Steel Processing
- ☐ Steam Boiler Maintenance

TURCO PRODUCTS, INC.

LOS ANGELES • SAN FRANCISCO • CHICAGO

HEAD OFFICE: 6135 So. Central Ave., Los Angeles

Sales and Service Representatives and Warehouse Stocks in All Principal Cities

Factories in Los Angeles and Chicago

What's New From DuPont?

SULFAMATE LEAD PLATING

Faster, Safer Method Provides Smooth Dense Deposits at 100% Current Efficiency

The sulfamate solution is less corrosive and safer to operate than the old type. It is easily made up and maintained with prepared sulfamate lead salts, and controlled in the usual way. Its simplicity, long life and stability bring economical operation to still or barrel plating.

The process is carried out in the usual rubber- or Neoprene-lined steel plating equipment. Simple addition agents are added as required. Smooth, dense, relatively pore-free coatings from 0.00005" to 0.0025" in thickness are readily obtained. Though not especially suited to decorative requirements, the lead deposit furnishes high corrosion-resistance to parts intended for use under many severely corrosive conditions.

Technical information and assistance in the specific application of the process can be obtained from our nearest district office. Electroplating Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Delaware.

DU PONT
REG. U. S. PAT. OFF.

ELECTROPLATING

CHEMICALS • PROCESSES • SERVICE

BE·TER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

MAKE THE LOAFERS WORK

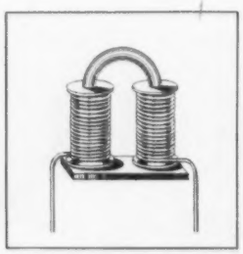
TIME was when amps given to gallivanting were allowed to get away with it. Kittenish kilowatts could stray from their work of running plating generators and nobody bothered to make them behave. That, of course, was yesterday.

Today, these culprits are being rounded up and made to work, because industry needs all available help in producing power. The quick way to make loafing amps work is to equip your plating generators with the right brushes. How can one know for sure which brushes are "right"? By asking SPEER—with forty-five years experience in brush pioneering and in commutation engineering. SPEER will be glad to recommend the grade of brush with best characteristics for any specified job. There is no charge for this service—it is part of SPEER'S effort to speed victory. Here is all you need do: request a SPEER Brush Data Form for each plating generator you wish to improve. Return the filled-in forms to SPEER. You will receive prompt recommendations based on unmatched experience. The rest is up to you.

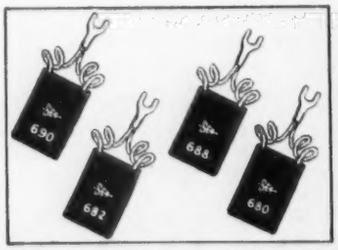
PROMOTE COPPER SALVAGE

Save the shunts and connections from discarded brushes. This helps to salvage copper needed for war material. Keep it moving to your salvage dealer as fast as it is accumulated.

Famous American Firsts



Electro-Magnet 1828



SPEER BRUSHES For the newer interpole platers — SPEER Grade 690. For the older non-interpole machines—SPEER Grade 682. For the very old machines converted from gauze to block brushes — SPEER Grades 688 or 680.
There is one right brush grade for every job—and SPEER makes it.

SCC

SPEER

CARBON COMPANY

ST. MARYS, PA.

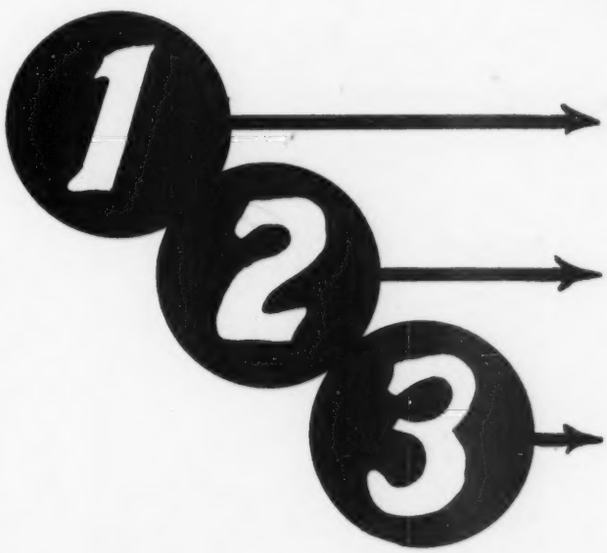
CHICAGO · CLEVELAND · DETROIT
MILWAUKEE · NEW YORK · PITTSBURGH

3870A

WE BUY

Stevens

BUFFING COMPOSITIONS



Because Stevens has had over forty years' experience in MANUFACTURING the finest grades of Buffing Compounds obtainable.

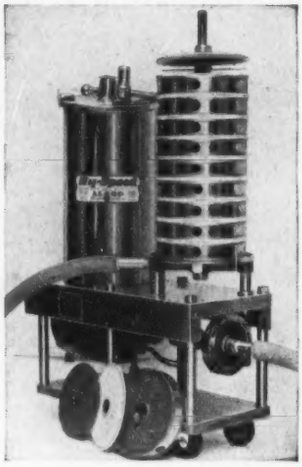
UNIFORM QUALITY—in every cake or tube—is assured, due to strict laboratory control in the manufacture of every product. This is particularly important NOW—when so many war production parts must be turned out with speed and precision, and must meet rigid inspection.

STEVENS engineering service is available at all times, in recommending the "right materials" for any given job—and to otherwise help in solving various buffing problems.

On your next job, try either
STEVENS TAMPICO COMPOUND, or
STEVENS GREASELESS COMPOSITION

FREDERIC B. STEVENS, INC.
DETROIT, MICHIGAN
New Haven Buffalo Cleveland Indianapolis Windsor Toronto
"EVERYTHING FOR THE POLISHING AND PLATING PLANT"

Why Plating has Improved



If you were to examine one of Alsop Filter Discs after a filtration of any of your plating solutions, you would be amazed at the amount of dirt, slime, and all other impurities that had been filtered out of the liquid.

DIRTY SOLUTIONS ARE THE CAUSE OF MANY OF YOUR PLATING TROUBLES

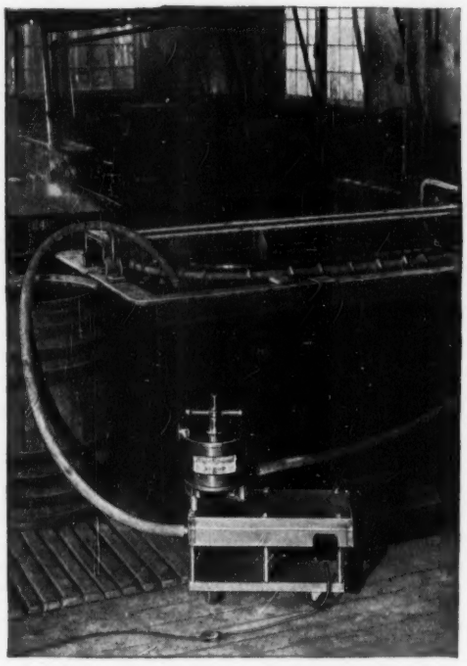
Remove the causes by the inexpensive, economical and certain method of keeping liquids clean

THE "*SEALED DISC*" WAY

and you will be sure to get

FINER PLATED SURFACES
INCREASED PRODUCTION
FEWER REJECTS
SAVE TIME AND MONEY

This view of a typical plating room gives you some idea of the small, compact portable Alsop "Sealed Disc" filter that does such a fine job. We make them in all sizes and types for any filtering job.



●

Ask your plating supply man
HE Knows.

●

ALSOP ENGINEERING CORP.
24 Bright Street **Milldale, Conn.**

IS CHROMIUM PLATING YOUR ANSWER TO EXTENDING THE LIFE OF VALUABLE TOOLS AND EQUIPMENT?

SALVAGE for example...

CHROMIUM PLATING may reclaim many parts when worn or machined off-size

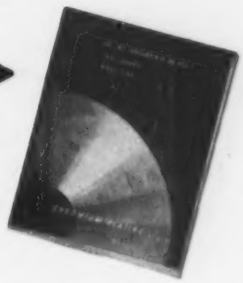
THE PROBLEM of replacing parts of worn equipment and production tools is frequently solved by building up the worn areas with chromium. Many plants also use chromium plating to reclaim parts which have been machined off-size and would otherwise have to be scrapped. Time and material saved in this way are especially important to the war effort. In addition, the reclaimed part often lasts several times longer than the original piece due to the hardness and wear resistance of the chromium plated surface.

For example, one plant salvaged several hundred cut and draw punches with off-center punch bearings by grinding them oversize and then chromium plating. Another had just completed an order for 700 spindles when the specifications were changed. Too small by several thousandths, they were salvaged by building up with chromium. Steel shafts on pumps handling corrosive liquids had to be replaced every few months . . . Reclaimed by chromium plating, they have shown no sign of wear in three years!

FOR MANY OTHER PARTS AND TOOLS

These are just a few of countless ways that chromium plating saves valuable materials and man-hours today . . . by extending the life of a wide variety of surfaces subject to wear and corrosion. Successful applications for both new equipment and salvage include:—coating and drying rollers, molding and mixing equipment, ball and roller bearing parts, cylinders, cylinder liners and piston rings, shafts, axles, pistons and many types of taps, dies, reamers, spindles, fixtures and gauges.

Booklet describes these applications in detail ➡



"The Last Thousandth of an Inch" will assist in determining the application for chromium plating on your products and equipment. In writing for your copy, please mention Metal Finishing.

UNITED CHROMIUM

INCORPORATED

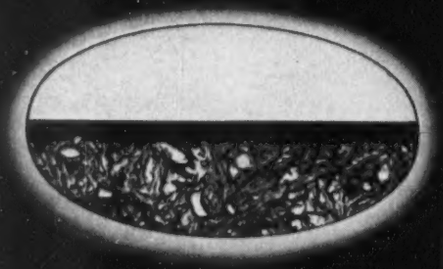
51 East 42nd Street, New York, N. Y.

Waterbury, Conn. ☆ **Detroit, Mich.**

THE MODERN BLACK FINISH FOR STEEL

Pentrate

PHOSPHANIUM BLENDED



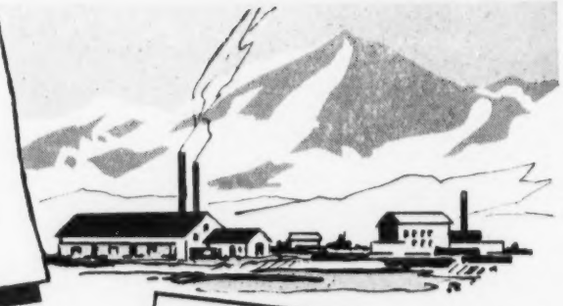
A CHOICE,
NOT A SUBSTITUTE

Thousands of steel items for military and civilian use looked first to Pentrate for a good available protective finish. Today, if other types of finishes were available most of these products would continue to use Pentrate — their choice because of performance. The photo-micrograph, made in an impartial laboratory, shows the actual penetration of this finish.

HEATBATH CORPORATION
SPRINGFIELD, MASSACHUSETTS

PATENTED

A PUMICE
TO MEET EVERY NEED



Not until Valencia – the standard of American Pumice– was discovered at Grants, New Mexico, was it thought that a domestic pumice could match the quality of imported Italian Pumice. This inexhaustible deposit at Grants is true pumice stone and not a volcanic ash. It is physically and chemically equal in every respect to the now unobtainable Italian Pumice. • The Valencia plant's output of grades for every need is rigidly under control for particle size, purity, weight and color.

Check this table comparing Valencia with the highest grade of imported Italian Pumice. See for yourself that Valencia is truly the standard of American Pumice.

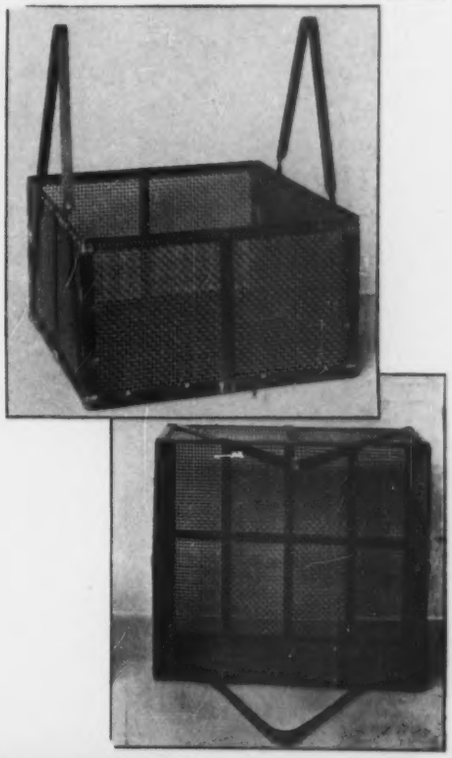
	American Pulverized Per Cent	Italian Select Per Cent
Silica	72.90	73.24
Alumina	11.28	10.61
Iron Oxide	.86	1.57
Titanium Oxide	.06	.10
Calcium Oxide	.80	1.10
Magnesium Oxide	.36	.40
Soda	3.64	3.03
Potash	4.38	5.58
Sulphuric Anhydride	.03	.05
Loss on ignition	5.20	4.04

Distributors of
THE PUMICE CORPORATION
of
AMERICA
GRANTS NEW MEXICO

WHITTAKER, CLARK & DANIELS, INC.
260 WEST BROADWAY • NEW YORK CITY
Warehouses: Detroit, Michigan and South Kearny, N. J.

3497

KIRK & BLUM BASKETS
help speed Processing Schedules



because they are designed and built to meet your specifications.

If you require special equipment in your processing department, consult Kirk & Blum Engineers. They will study your problem and make recommendations for the best type of baskets, buckets, or crates needed for the efficient handling of metal parts in your processing departments.

Meet today's demands for greater production with Kirk & Blum equipment engineered to fit your needs.

Write for Booklet—

"DATA on KIRK & BLUM PRODUCTION FACILITIES"

or any of the following:

"Dust Collecting Systems in Metal Industries"
"Blower Systems for Woodworking Plants"
"Fan Systems for Various Industries"
"Cooling Systems for the Glass Industry"
"Industrial Ovens"

THE KIRK & BLUM MANUFACTURING CO.
AN ORGANIZATION OF ENGINEERS AND MECHANICS
2859 SPRING GROVE AVE. CINCINNATI, OHIO

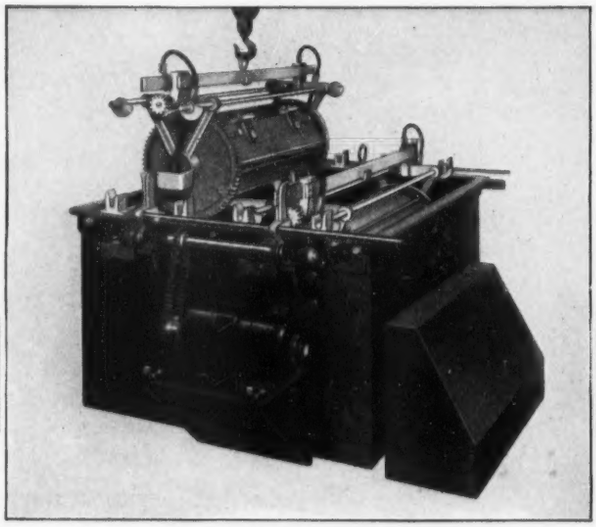
ANODIZING LICENSES AVAILABLE *NOW*

TO JOB PLATERS AND MANUFACTURERS

To relieve present congestion in aluminum anodizing under Specification QQA-696-a approved (Sulphuric Acid Type).

A few exclusive territorial licenses to job platers are still available.

TECHNICAL PROCESSES DIVISION
OF COLONIAL ALLOYS COMPANY
COLONIAL PHILADELPHIA BUILDING
PHILADELPHIA, PA.



Twin Unit
Barrel Plater

For Faster, More Uniform Plating and Lower Maintenance Costs—

Specify LASALCO

Multiple Unit Barrel Platers

★ The Lasalco Platers are designed to give a maximum of production with a minimum of labor — and that's important today when every hour gained will shorten the war. Lasalco Multiple Plating Units can increase the amount of production per man-hour.

Because these machines are ruggedly and carefully built under rigid specifications, they will stand up under today's 3-shift production with practically no time out for maintenance.

Get complete information on these platers and other Lasalco plating and finishing room equipment and supplies by calling in a Lasalco Engineer.

LASALCO, INC.

2818-38 LaSalle Street
St. Louis, Missouri

from BRASS to STEEL CASES

for .22 to .45 caliber and 37 MM to 105 MM's —and cleaned with WYANDOTTE

A change from brass drawn cartridge cases to steel cases presents new cleaning problems—problems that Wyandotte Engineers have already met.

Due to the successful work of Wyandotte Cleaning Specialists with pilot line operations, steel drawn cartridge cases are being cleaned rapidly and economically.

Wyandotte has developed special degreasing compounds for cleaning the steel discs—for the cleaning operations between draws, either when a drawing compound alone is used or when the steel is Cuprodined, Bonderized, or copper-plated for drawing purposes—and for cleaning the finished case before final finish.

Wyandotte Metal Cleaning and Degreasing Products together with the experienced service given by Wyandotte Field Engineers are proving of value to manufacturers of cartridge cases, projectiles, bomb bodies, bomb fins, airplane motor parts. . . . There is a Wyandotte Cleaner for every metal cleaning job and for use in all types of equipment.

Your Wyandotte Representative is ready to help you now.

SERVICE REPRESENTATIVES IN 88 CITIES

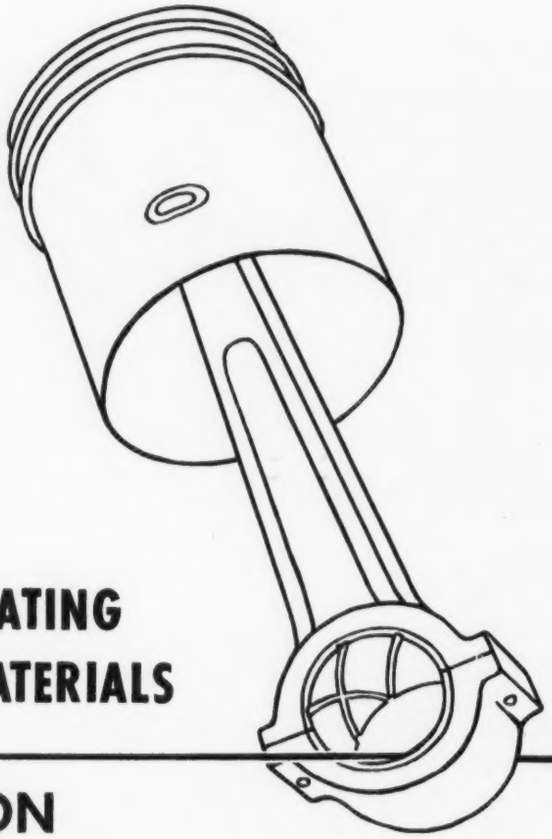
WYANDOTTE CHEMICALS CORPORATION
J. B. FORD DIVISION • WYANDOTTE, MICHIGAN

• Wyandotte Chemicals Corporation consolidates the resources and facilities of Michigan Alkali Company and The J. B. Ford Company to better serve the nation's war and post-war needs.

*HARSHAW'S **SILVER CYANIDE**

*HARSHAW'S **SILVER CHLORIDE**

*HARSHAW'S **SILVER NITRATE**



*3 SILVER PLATING MATERIALS

YOU CAN DEPEND ON FOR WARTIME PRODUCTION

Wartime is no time to risk production delays or rejections. When silver plated parts are rejected, precious hours of labor are utterly wasted.

To meet rigid silver specifications, and at the same time keep up your high-pressure schedules, start with materials you can depend on to give you the results you want.

Harshaw's Silver Cyanide, Silver Chloride and Silver Nitrate are carefully manufactured under strictly controlled conditions for rapid dissolving qualities, unusually high purity, and high silver content to give you smooth deposits that are uniform in both color and texture.

QUICK FACTS ABOUT HARSHAW'S SILVER PLATING SALTS

SOLUBILITY

Physical characteristics of the particles are especially developed to dissolve quickly and easily.

SILVER CONTENT

Metallic silver averages from 80.2% to 80.4% in Harshaw's Silver Cyanide . . . . 75.1% to 75.3% in Silver Chloride . . . . 63.4% to 63.5% in Silver Nitrate.

PURITY

Although they are commercially priced, Harshaw's silver plating chemicals have such a low percentage of impurity, they closely approach C.P. quality.

THE **HARSHAW CHEMICAL COMPANY**

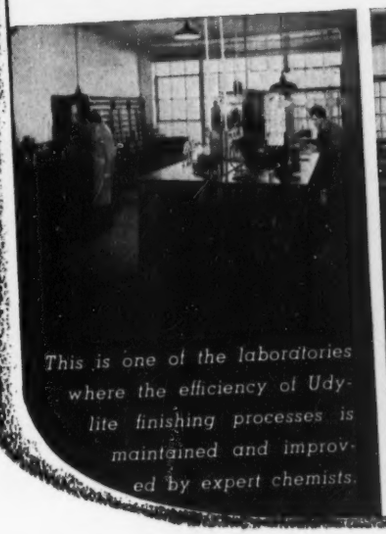
CLEVELAND, OHIO and PRINCIPAL CITIES

HARSHAW

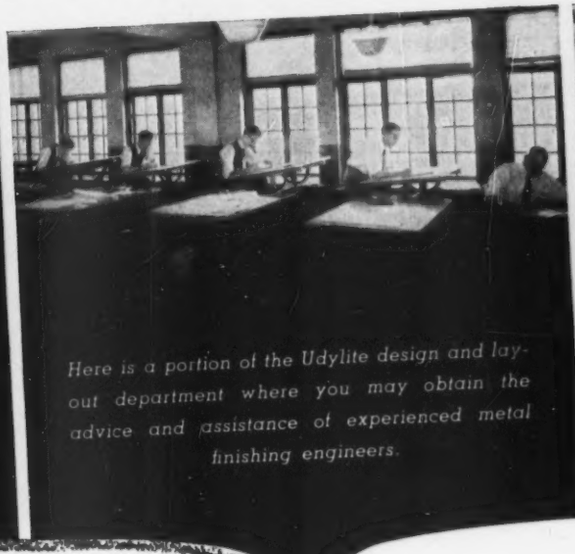
*

UDYLITE

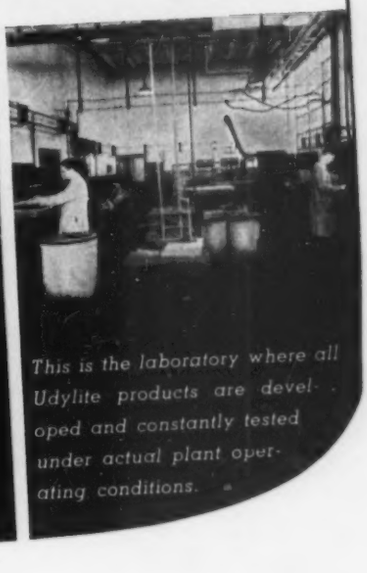
HEADQUARTERS FOR ELECTROPLATING, POLISHING AND ANODIZING INFORMATION



This is one of the laboratories where the efficiency of Udylite finishing processes is maintained and improved by expert chemists.



Here is a portion of the Udylite design and layout department where you may obtain the advice and assistance of experienced metal finishing engineers.



This is the laboratory where all Udylite products are developed and constantly tested under actual plant operating conditions.

★ ★ ★ ★

For prompt, dependable metal finishing information, call on Udylite. No organization is better equipped to give you information gained from installing plating, polishing and anodizing departments in many leading manufacturing plants throughout the country. ● Trained plating engineers and electrochemists are at your service. These men *know* metal finishing and they can help you plan a new installation or revise your present one for greater efficiency. They know, also, that you want information quickly. ● Udylite has a complete line of equipment . . . second to none in terms of quality and efficient performance. ● and supplies . . . for every metal finishing need. Salts, acids, anodes, buffing and polishing materials—everything required. ● Call Udylite for prompt service on your finishing requirements. You pay no more for Udylite dependability.

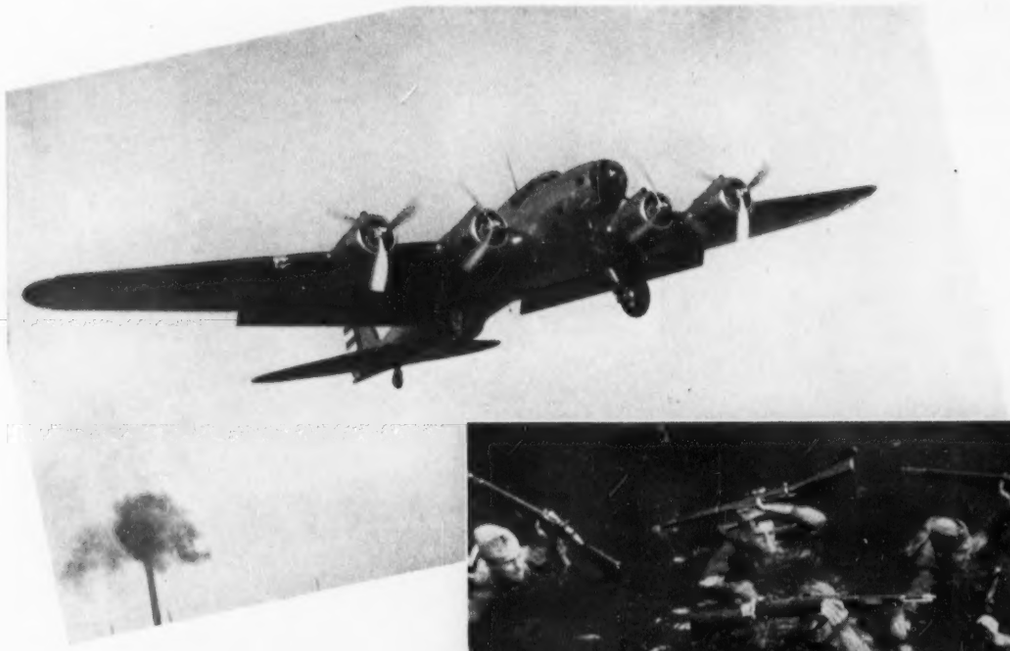
THE UDYLITE CORPORATION

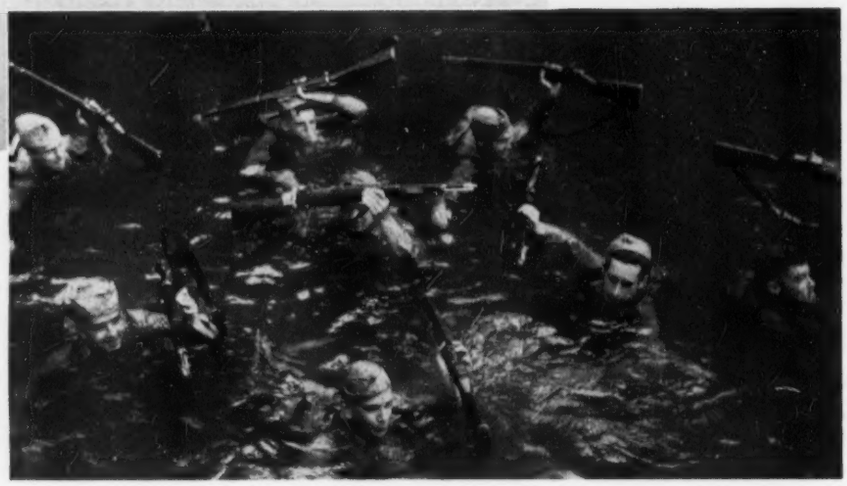
1651 E. Grand Blvd., Detroit, Mich.

New York
60 E. 42nd Street

Chicago
1943 Walnut Street

Cleveland
4408 Carnegie Ave.





Engineering Authorities Recognize Du-Lite as a Definite Aid to Lubrication

DU-LITE has been found to be a very satisfactory finish for various steel parts, whether soft, low carbon steel or heat treated parts of alloy steels.

In addition to its attractive appearance Du-Lite is durable and a protection against rust. The use of Du-Lite as a finish is widely known. Its use as an aid to lubrication, however, is not so well known.

Du-Lite processing smooths the microscopic roughness present on even highly polished surfaces and produces an oxide film which absorbs and holds oil. This combination has been found to be a definite aid to lubrication. Furthermore there are no dimensional changes through the use of Du-Lite, and extremely close tolerances are maintained without allowance for build-up.

On cutting tools Du-Lite also acts as an aid to lubrication by preventing chips from sticking to the cutting edge. It is most effective for taps, reamers, drills, milling cutters, and dies.

Du-Lite representatives cover the industrial section of the country and are available for consultation on your individual problems. Send for latest information.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONNECTICUT

Baker Palladium Plating Solution

TO MEET THE WAR EMERGENCY

Because palladium is the only white metal remaining for tarnish resistance and decorative plating, we have devoted a great deal of research to obtain the best possible plating solution and now offer Baker Palladium Plating Solution to meet the emergency.

Baker Palladium Plating Solution is stable and *does not decompose* during use.

A flash plate, which requires no polishing, is produced in from 15 to 60 seconds.

Heavy deposits can be made from the same solution.

You can plate directly on base metal or silver for tarnish prevention.

Its stability, its uniform performance and the results obtained will justify all our claims for it. If you are using some other solution now, try Baker Palladium Plating Solution and compare results.

That's fair, isn't it?

BAKER & CO., INC.
113 Astor St., Newark, N. J.
NEW YORK SAN FRANCISCO CHICAGO

AMINCO-BRENNER

AMINCO

MAGNE-GAGE

Measures Thickness Of Coatings on Metals

Magnetic Coatings on Non-magnetic Base Metals
Non-magnetic Coatings on Magnetic Base Metals
Nickel Coatings on Iron or Steel

Rapidly and Non-destructively

★

How You Can Profit

by using the Magne-Gage

The Magne-Gage soon pays for itself (ofttimes in a few weeks, depending on the number of measurements made), and will continue to be a profitable investment long after its initial cost will have been absorbed, because:

★ Measurements are made in a fraction of the time required by conventional methods. The time it saves gives your staff the chance for activity on other jobs.

★ It eliminates costly rejections, since it readily reveals whether or not the thickness of plating conforms to specifications.

★ Every piece tested is unharmed and ready for use or shipment.

★ It eliminates time-wasting, tedious, test procedure.

★ It eliminates the expense involved in replating or discarding specimens spoiled by destructive test methods.

★ No upkeep expense is involved in its use, and no auxiliary equipment or materials such as batteries, acids, tools, etc.

★ Its use readily suggests whether or not a re-design or rearrangement of plant equipment is necessary to produce a more nearly uniform distribution of coating. It lends itself, therefore, to increased production and a better product.

For works control or acceptance testing, you can apply the Magne-Gage method with profitable results . . . it will pay you to investigate.

RAPID . . . permits testing of a large number of specimens at low cost. with little experience.

NON-DESTRUCTIVE . . . will not injure the coating or the base metal.

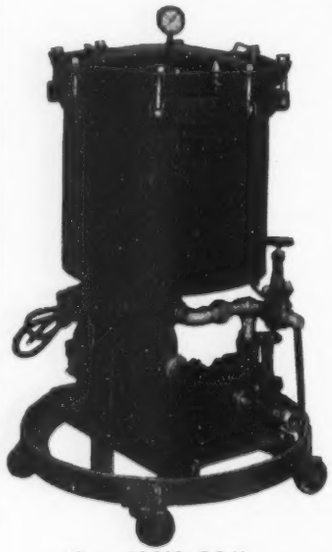
UNIVERSAL . . . applicable to plane, convex or concave surfaces.

COMPACT . . . PORTABLE . . . weighs only 7½ lbs.

Write for Bulletin MF-2070

AMERICAN INSTRUMENT CO.
8010 GEORGIA AVENUE · SILVER SPRING, MARYLAND

Filtering Solutions IS Necessary!



60 to 10,000 G.P.H.

Use SPARKLER HORIZONTAL PLATE FILTERS

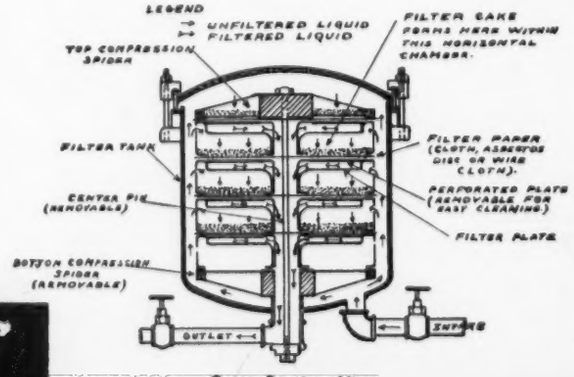
We all know that under the present stress of war production, it is highly important to keep plating solutions free from foreign substances.

Why not do it efficiently with a minimum of cleaning time?

Ample cake space provided in a Sparkler.

Sparkler Filters use all filter aids — diatomaceous earths, filter papers and filter cloths —to equal advantage. Simple to clean and change.

Write for free engineering counsel and filter test.

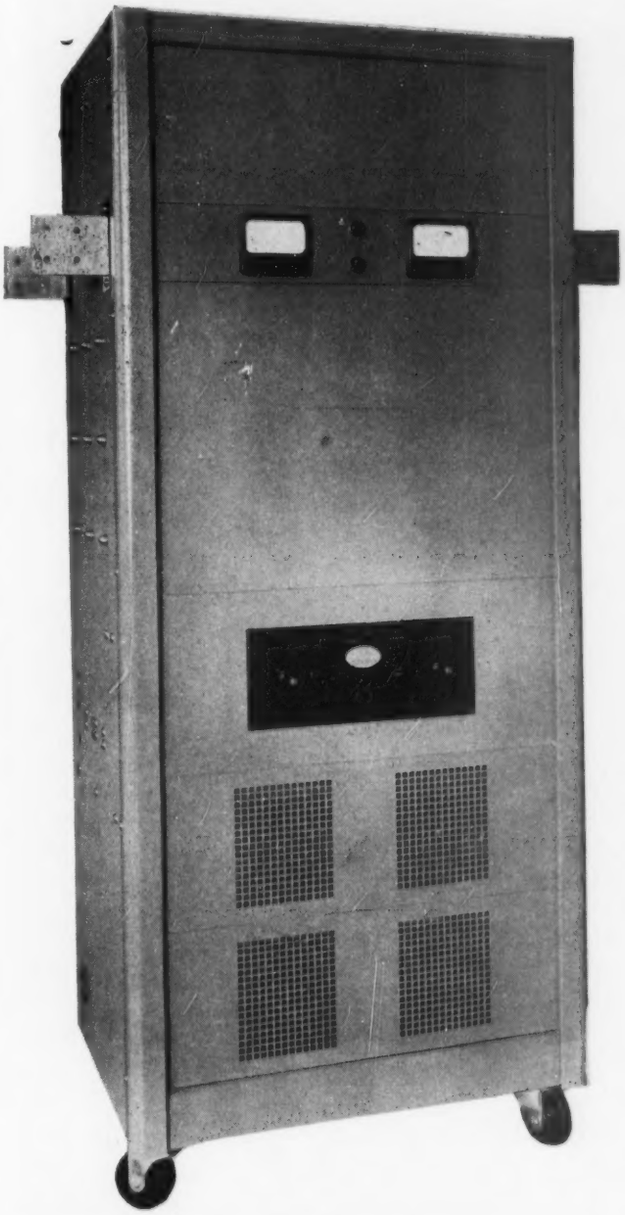


Cross Section View

SPARKLER MANUFACTURING CO.
285 Lake Street MUNDELEIN, ILLINOIS

SPARKLER FILTERS
WITH THE HORIZONTAL PLATES

re: CONSERVATION



MATERIALS

This Selectro-Plater delivers 1800 amperes at 12 volts for *electro-plating. It weighs only **1800 pounds** complete—a saving of up to **70%** in copper and steel.

POWER

Efficiency of 65% to 75% **maintained** from full load down to 10-15% of full load. Instantaneous start and stop permits **shutdown between loads.** Power factor over 0.95.

FLOOR SPACE

Total floor space required only 6 square feet—a saving of up to **95%** in working space. No additional space is needed for auxiliary equipment.

INSTALLATION

Mobile unit — **roll** into place. No special foundations or framework, no riggers. Shift to new location quickly at any time.

WIRING

Starting equipment, voltage controls, protective devices, supervisory lamps, meters—**all** in one cabinet. Simply connect to power supply and tanks—and it is ready to produce.

MAINTENANCE

For 20KW DC output only two small motors totalling ¼ hp. All major parts are static and not subject to wear. Negligible maintenance, no periodical overhaul, no replacements, unlimited life.

USE 24 HOURS PER DAY-7 DAYS PER WEEK

* *Write for illustrated booklet showing more types. Selectro-Platers are built for 6, 12, 18, 24, 36, 48 volts and higher in current ranges from 50 to 3000 amperes and higher. Units are engineered for electro-plating, electro-cleaning, electro-polishing, anodizing, etc.*

W. GREEN ELECTRIC CO., INC.

ESTABLISHED 1892

Builders of SELECTRO-PLATERS and all types of rectifier equipments.

Green Exchange Bldg., 130 Cedar St, New York

US
EQUIPMENT
SINCE 1896
For Plating, Metal Cleaning, Pickling, Acid Dipping, Drying and Allied Operations
FULLY AUTOMATIC SEMI AUTOMATIC
MANUALLY OPERATED
PLATING BARREL APPARATUS
STILL TANK PLATING EQUIPMENT
VARIABLE SPEED PLATING APPARATUS
AUTOMATIC CLEANING & PLATING UNITS
CONTINUOUS ACID TREATMENT EQUIPMENT
MECHANICAL CLEANING APPARATUS
ELECTROLYTIC PROCESSING UNITS
GENERATOR EQUIPMENT
DRYERS, ETC.
U. S. GALVANIZING & PLATING EQUIPMENT CORPORATION
Incorporated 1896
31 Heyward Street, Brooklyn, N. Y., U.S.A.

Founded as METAL INDUSTRY, January, 1903 by
PALMER H. LANGDON
1868-1935

METAL FINISHING

VOLUME 41 APRIL, 1943 NUMBER 4

Publication Office:
11 West 42nd St., New York

L. H. LANGDON
Publisher

THOMAS A. TRUMBOUR
Business Manager

NATHANIEL HALL and G. B. HOGABOOM, Jr.
Associate Editors

PALMER H. LANGDON
Assistant Editor
Corps of Engineers, U. S. Army

JOAN TRUMBOUR
Advertising Manager

PUBLISHED MONTHLY—Copyright 1943 by The Metal Industry Publishing Company, Incorporated, 11 West 42nd St., New York, N. Y. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, $2.00 per year; Canada, $2.50 per year (includes 50c exchange and tax). Foreign $5.00. Single copies 25c. Please remit by check or money order; cash should be registered.

ADVERTISING RATES on application. Forms close the first of the month. Advertising copy should be mailed in time to reach us on or before the 20th of the preceding month.

METAL FINISHING reserves the right to investigate all products offered for advertisement, to refuse advertising considered unsuitable and to edit advertising copy when necessary.

CONTENTS

Editorial 197

Motor Generator Sets and Rectifiers in the War Effort—By C. E. Berger 198

Modern Design in Electroplating—By Gerald Eldridge Stedman 199

An Interpretation of the Mechanism of Bright Electroplating—By John A. Henricks 202

Cadmium Plating—By Gilbert Tramer 211

The Use of "Cuprodine" as a Lubricant in the Drawing of Steel Cartridges—By G. S. Gardner 212

Turpentine—By Stanley T. Dingman 245

Flame-Priming Method of Preparing Steel Surfaces for Painting—By E. W. Deck 249

Color-Mixing and Matching—By L. F. Wade 255

Finishing Aluminum Parts for Military Aircraft 257

DEPARTMENTS

This Is Washington 207

Dictionary of Metal Finishing Chemicals 213

Fundamentals of Science Relating to Electroplating 215

Shop Problems 217

Patents 219

New Equipments and Supplies 220

Manufacturers' Literature 225

Courses of Instruction 227

New Books 227

Associations and Societies 228

News from California 230

Business Items 233

Prices 240

Odds and Ends 36

The INDIUM Corporation of America

Authority on the Subject of INDIUM

1 . . . by virtue of years of research into the sources, extraction and purification of this important alloying element for the non-ferrous metals.

2 . . . by virtue of the extensive studies of its properties and usefulness.

3 . . . by virtue of active technical cooperation with many manufacturing firms utilizing one or more of its properties to greatly improve their own products.

If you are manufacturing products from non-ferrous metals, it is probable that the addition of INDIUM would be helpful. Our research department – authority on the technical phases of INDIUM – will be glad to cooperate.

Outline of Properties Imparted by **INDIUM** *to Non-Ferrous Metals:*

- Great increase in their tensile strength and fatigue resistance.
- Great increase in their hardness and wear-resistance.
- Great increase in their corrosion resistance.

The INDIUM Corporation of America

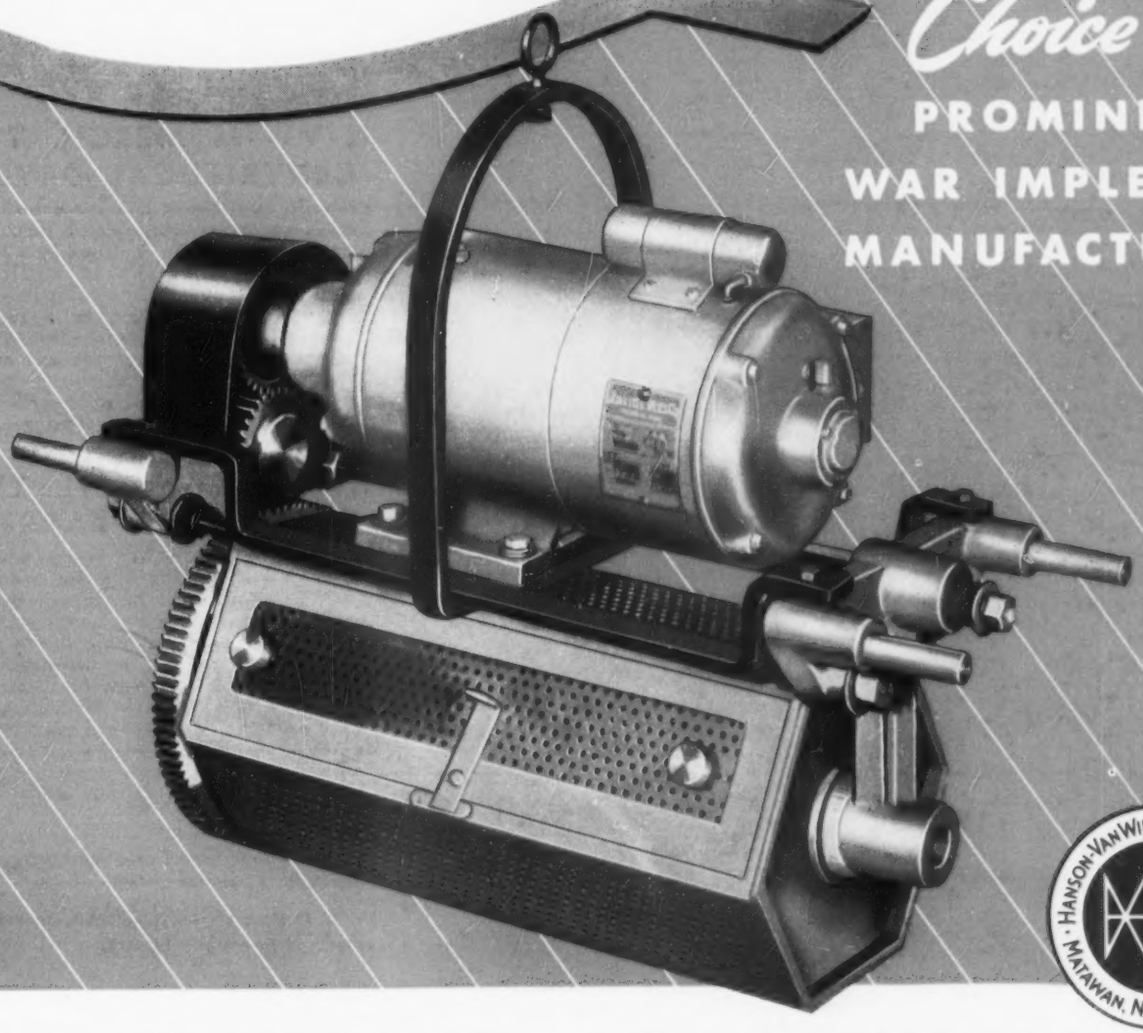
UTICA, N. Y.

***New York Office:* 60 East 42nd Street**

No. 4-IC-2

NEW MERCIL TYPE *Portable* BARREL APPARATUS

Choice of
PROMINENT
WAR IMPLEMENT
MANUFACTURERS



HANSON-VAN WINKLE-MUNNING CO. · MATAWAN, NEW JERSEY, U.S.A. ·

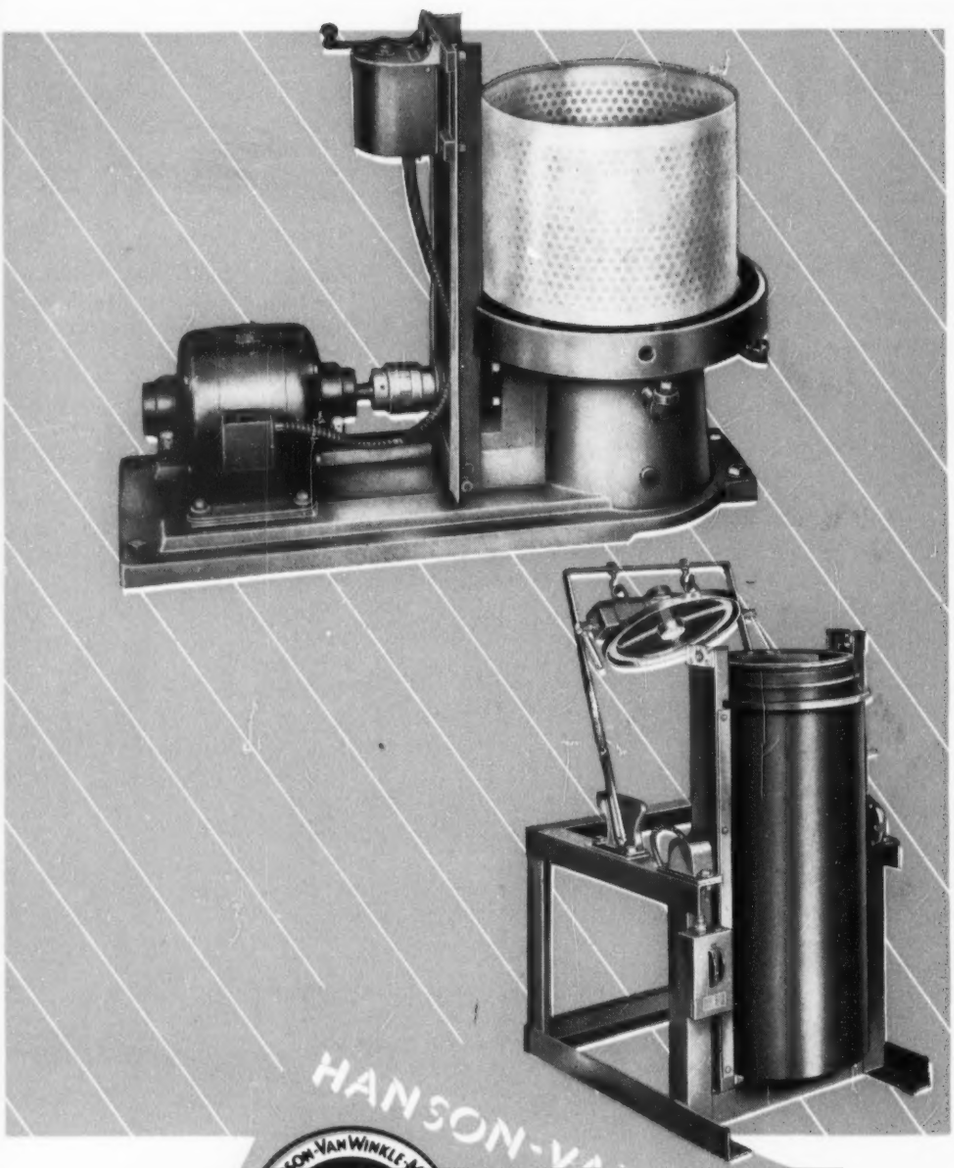
This H-VW-M Portable Barrel apparatus is finding increased popularity among war-implement manufacturers. Its unique design and exclusive features permit faster plating of small parts and a more even flow of work. The use of this apparatus reduces plating time and decreases the number of rejects. In addition, H-VW-M Mercil Portable Plating Barrel apparatus is adaptable for use in conjunction with your present tank equipment. It can be furnished with a steel cylinder 8" in diameter by 18" long, suitable for cleaning solutions and black oxidizing baths. Monel cylinders of the same size but with leaded bronze hangers are available for pickling baths. Bakelite cylinders 6" x 12" are furnished for plating solutions and for the Bullard Dunn Process descaling bath.

The unit is driven by a 1/6 HP drive. The motor is of the totally enclosed type mounted on the tie rod assembly directly above the cylinder. The unit is constructed so that it can be carried by hoist. If desired, the apparatus can be furnished with a clamp that can be fitted to the cathode rod on the top.

Where the cylinders are to be used in plating solutions, chain type dangler contacts are furnished.

HANSON-VAN WINKLE-MUNNING CO.

TO SAVE TIME AND IMPROVE UNIFORMITY ON WAR WORK



Where small parts are handled on a production basis, H-VW-M Mercil Type Centrifugal Dryers* and Burnishing Barrels* speed work and enable uniform, accurately predetermined results. Both units occupy minimum floor space. Both are ideal for use with plating barrels.

H-VW-M MERCIL TYPE CENTRIFUGAL DRYERS

provide the speediest, most economical method of drying small plated parts. Two sizes are available: No. 1, driven by a ½ H.P. motor, handles baskets up to 12″ x 12″; No. 2, driven by a 1 H.P. motor, handles baskets up to 18″ x 18″. Both sizes can be furnished with forced hot air drying equipment, either electrical or steam. Large bearings and excellent balance virtually eliminate vibration. Conveniently located motor control facilitates starting, stopping, or reversing at will.

H-VW-M MERCIL TYPE BURNISHING BARRELS

are self-contained units, hence unusually simple to install. Barrel, drive gears and motor are all mounted in one movable unit, permitting direct drive and operation at any angle. A unique cover lifting device speeds and simplifies loading. The barrel proper is octagonal, made of welded sheet steel and equipped with hard maple blocks. A steel shield covers barrel, motor and gears, making the unit completely splash-proof. Two sizes are available: No. 1, with inside dimensions 11⅜″ x 24″ and No. 2, with inside dimensions 14¼″ x 30″.

***H-VW-M Mercil Type Centrifugal Dryers are described in Bulletin CD-101.**

H-VW-M Mercil Type Burnishing Barrels are described in Bulletin BB-103.

3795

HANSON-VAN WINKLE-MUNNING CO.
MATAWAN, NEW JERSEY

PLANTS • Matawan, New Jersey • Anderson, Indiana • Bridgeport, Connecticut
SALES OFFICES • Anderson • Bridgeport • Chicago • Cleveland • Dayton
Detroit • Elkhart • Matawan • Milwaukee • New Haven • New York
Philadelphia • Pittsburgh • Springfield (Mass.) • Syracuse

Manufacturers of a complete line of electroplating and polishing equipment and supplies

Vol. 41, NO. 4 METAL FINISHING APRIL, 1943
PREPARATION, ELECTROPLATING, COATING

ABSENTEEISM

It seems that every time we open a newspaper or magazine these days someone is complaining about absenteeism in war industries—and not only is the treatment of this subject becoming very involved but so far as we are concerned, it is also becoming very tiresome.

One week we read that so and so suggests that more women be employed because their attendance record is better than that of men. The next week we pick up our evening paper and learn that, according to Secretary of Labor Perkins, absenteeism among women in war industries is twice as great as among men. From their comfortable chairs, editors with an anti-labor slant have been declaiming about the "causes of absenteeism" including among them high wages and week-end dissipation, and they have at times employed the words traitor and saboteur in their diatribes. But what do they know about real causes?

Do they know that, because of lack of housing, war workers in Bridgeport, Conn., have commuted daily from as far away as New York? Do they know how it feels to spend ten hours a day, six days a week (and sometimes seven), week after week, performing the same monotonous operations on a machine? What do they have to say when, among the principal causes of absenteeism given by Secretary of the Navy Knox, bad transportation, bad housing, long hours of work and monotonous jobs head the list? Do the words *traitor* and *saboteur* stick in their throats when they learn that the war workers at the Higgins shipyard in New Orleans have given more blood to the Red Cross for plasma than the rest of the city combined?

Latest reports indicate that educational campaigns have been impressing upon war workers, with excellent results, the need for better attendance records. Industry, however, has always been afflicted with a type of worker who will go on a spree whenever he has a dollar or two in his pocket, and since it has been necessary during the last year to scrape the bottom of the labor supply barrel, a larger percentage of such workers is unfortunately now being employed in war industries.

For such workers we hold no brief. Education will not change their habits of a lifetime and punitive measures will probably be required to keep them in line. But we do feel that when the torrents of abuse are being showered indiscriminately upon one group of our great production system, some of the fire and thunder should also be reserved for the master minds who decide on the construction of a war plant thirty miles from town, but forget or ignore the obvious fact that a worker has to have a place to live after he leaves the plant.

We believe that Senator Mead made the most pertinent comment on the situation when, during an examination of three of our prominent shipbuilders by the Senate Committee Investigating the War Program last month, he remarked: *"Perhaps we have been putting too much stress upon manpower, absenteeism and other common ills of industry. Perhaps other plants lack the leadership that has been shown here. Perhaps we need more Fergusons, Higginses and Kaisers."*

Motor Generator Sets and Rectifiers In the War Effort

By C. E. BERGER

Assistant Chief Engineer, Hanson-Van Winkle-Munning Co., Matawan, N. J.

MODERN warfare is a titanic struggle between people of different idealogies, and the victors will be those whose people on the home front are best equipped to produce more and better machines for the men at the front.

Electroplating in some form or other plays an important part in the tools of war as well as in the machines which produce those tools. One of the most essential parts of an electroplating process is a suitable source of current, and it is with this part that we are principally concerned.

The usual suppliers of motor generator sets and rectifiers for electroplating service find their manufacturing facilities completely absorbed by the production of this and similar equipment, and it is well to consider at this time the maintenance of present installations of motor generator sets and rectifiers.

To Those Who Own Motor Generator Sets or Rectifiers:

To those of you who own equipment of this type and are not using it, and will not have any use for it in the war effort, let me say that the sooner you arrange to make it available to those who do need it, the better it will be for our common good.

If you own such equipment and are using it, the more closely you follow the manufacturer's instructions as to its care and operation, the less likelihood there will be of its breaking down or failing at a critical time. Basically, the point which all manufacturers stress is "cleanliness." Whether your equipment is in generators or rectifiers, this is sound advice. Motor, generator and exciter windings should be thoroughly cleaned and kept clean as frequently as the location demands. Rectifiers also should be checked frequently so that dust, dirt or lint does not interfere with the ventilation of the unit. On rotating equipment, use the make and grade of brush specified by the manufacturer—making sure that the brushes move freely in the holders and properly fit the commutator. Brush pressures are important and should be adjusted to the manufacturer's recommendation by actual measurements with a spring scale and not simply guessed at. If you are using rectifiers, observe the manufacturer's recommendation as to allowable operation voltages and current overloads and do not permit them to be exceeded. If you have generators which were built to 25° C. or "heavy-duty" standards and have continuous overload ratings, go ahead and use them at these higher ratings if needed, instead of demanding more capacity. In other words, take good care of the equipment you have and load it up to full capacity so that the new equipment being produced may be used in the places of the greatest need.

To Those Who Need New or Additional Capacity:

If your plant requires new or additional generator or rectifier capacity, estimate your requirements carefully and conservatively. What started out as a reasonable estimate of the required capacity is likely to result in a size 50% or more too large if several people all add cumulative "safety-factors."

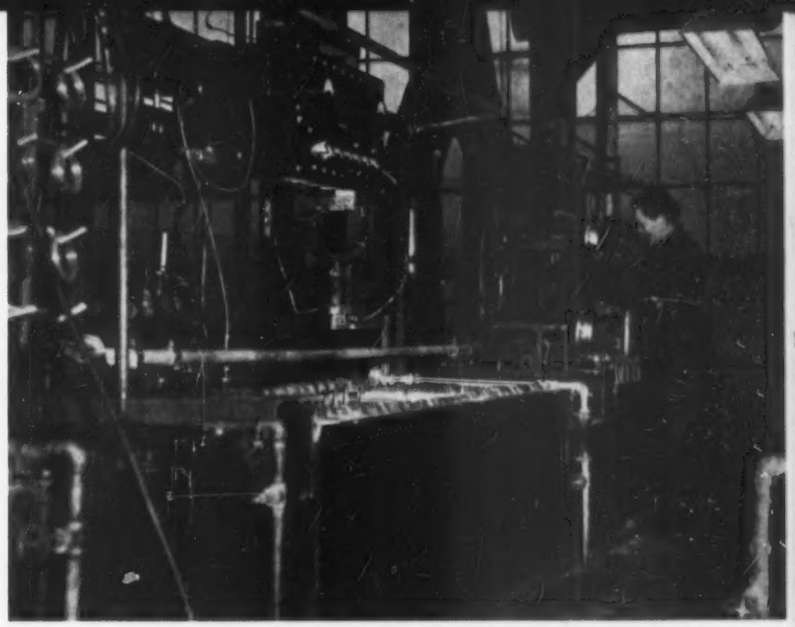
Your suppliers have standard ratings which are more readily produced than special ratings. Stick to them and do not ask for special ratings when standard ratings can be used. Cut out all the "gadgets" even though the D.P.C. is paying for it—they are hard to get. Limit your specifications for meters to the bare minimum—no meters are required in the A.C. supply and two meters are sufficient for any rectifier or induction motor-driven set or three for any synchronous motor driven set. Circuit breakers in the D.C. line, recording voltmeters, ampere hour meters, special push-button stations and similar equipment all can serve a useful purpose but should not be specified unless absolutely necessary to the successful operation of your process.

If you are fortunate enough to secure a new piece of equipment, follow the manufacturer's instructions implicitly as to location, operation and maintenance of the unit—and by all means *KEEP IT CLEAN!*

(Reprinted from "The Monthly Review," January, 1943, with permission of The American Electroplaters' Society)

Modern Design In Electroplating

By GERALD ELDRIDGE STEDMAN



View of copper plating cycle showing Part 110708 being turned during copper plating operation.

THE N. A. Woodworth Company, Ferndale, Michigan, has completed installation of the most compactly modern electroplating department I have ever inspected.

Woodworth has eliminated specialization and effected a set-up to handle volume in mine run manner, even though its plating is unusually varied among the many aircraft engine parts of its war production. For example, the smallest Woodworth part requiring plating is a cylinder head holdout screw 1 7/16" long x 23/32" diameter, of which millions are produced each month. The largest part is the rear propeller shaft thrust bearing retainer, the plating process of which I shall later discuss in sequential detail. There is a variety of 55 Woodworth war parts requiring processing; about 500,000 of these pieces per month require electroplating two or three times.

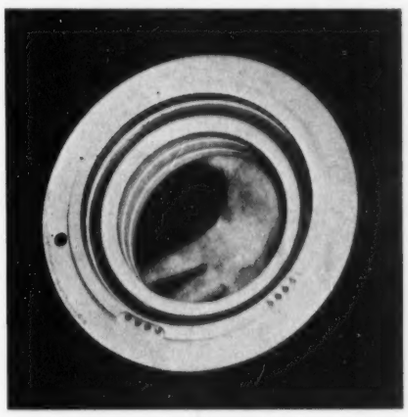
The Woodworth electroplating department is in charge of Gerald Burgess, able electroplating engineer, with departmental personnel numbering 85. Four types of plating are accomplished: (1) Chromium plating, to salvage pieces from over machining. (2) Copper plating, for selective carburization. (3) Cadmium plating, for corrosion resistance and protection. (4) Tin plating for selective nitriding

Cycle of Operations

The department has a racking and plating division, connected by a 160-foot overhead dual conveyor system which picks up carrier trays and serves six plating cycles at designated speed with maximum convenience to plating operators. The typical composite flow sheet of operations is (1) By carrier tray from other departments to (2) racking for plating to (3) conveyor delivery to (4) plating cycle to (5) heat treat to (6) copper stripping to (7) machining to (8) cadmium plating to (9) grinding to (10) shipping. Chromium plating is done in a room separate from the regular plating department.

The success of any plating operation depends upon proper coordination of chemicals, processes and materials. The Burgess layout of this Woodworth plating department is the last word in coordination. Looking into the department, the conveyor line travels at the left side to feed six cycles of baths for copper, cadmium, tin plating and copper stripping which finger off to the right. The usual cycle consists of 13 varied cleaning, rinse, dip and plating baths. Looking into the U-formed cycle, the feed from the conveyor is to the baths at the right with return to the conveyor on the left and at the point where the conveyor first approaches the cycle.

Visualize the U-arrangement of six baths on each side of a 40" aisle, the conveyor passing the front and the back of the aisle backed by the plating tank, and you have a picture of the Woodworth cadmium plating cycle. The cyclic sequence of baths, starting at the right, is: (1) Alkaline cleaner in which the piece is soaked clean. (2) Warm rinse to wash off soaps. (3) Electroclean (anodic) for final cleaning and to remove any solid metal or abrasive left by polishing wheels. (4) Cold water rinse to remove the alkaline medium. (5) A 15 per cent muriatic acid dip to remove superficial oxides that cause discoloration. (6) Cold water rinse as a final conditioner to cadmium plating. (7) Cadmium plating in a standard bright plating bath. This is at the end of the aisle. Then, returning on the left, (8) Cold water rinse. (9) Cold water



Close-up view of copper plated part 110708, showing stopped-off counter bore and inside diameter.

Part 110708 prepared for chromium plating the inside diameter. The operator points to the area to be plated.

View of laboratory where analyses of plating solutions are made. Mr. Burgess is in the foreground.

rinse. (10) Chromic acid dip for passivation of the cadmium surface. (11) Cold water rinse. (12) Final cold water rinse. (13) Hot water rinse. The piece is then air dried at a final station before being returned to the conveyor, the plating complete. Two such cadmium plating cycles are maintained.

The cycle of tin plating is almost identical—the only difference being in the number of rinses. Following the tin plating, the work receives but one rinse. An alkaline stannate bath is used. All of these cycles are broken into units as such for two purposes: (1) To effect simplified operation, which among other advantages, has made it easier to train operators. (2) To provide uniform flow of production.

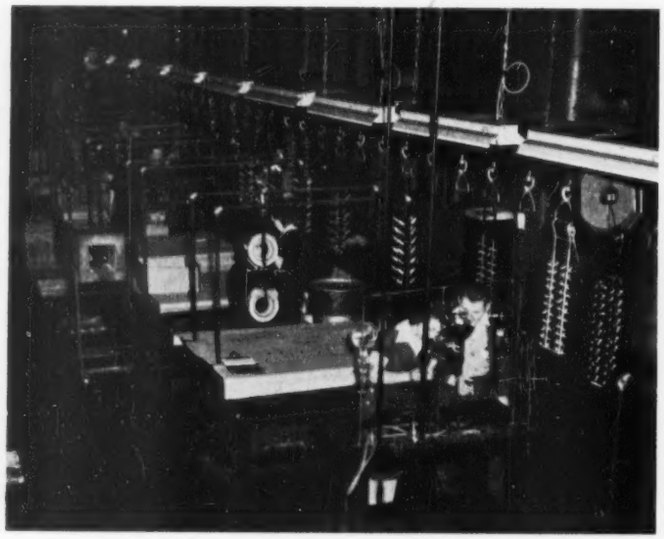
The right hand part of the copper plating cycle is identical to that of cadmium and tin. The left hand sequence is: (7) Copper strike—a low metal, high free sodium cyanide concentration bath. (8) A tandem high speed copper plating bath. (9) Cold rinse. (10) Warm rinse. (11) Air dry.

The last cycle (nearest the racking division) is the copper stripping sequence, right and left arrangement being the same. This consists of a series of four baths: two for copper stripping, one for rinse, one for hot water bath. The anode for copper stripping is the work bar, geared from the center, upon which the work is hung and oscillated. The cathode member is the outside bar of the tank. Current is merely the reverse of plating. The 220 AC current is transformed to between 6 and 7 volts and rectified to DC.

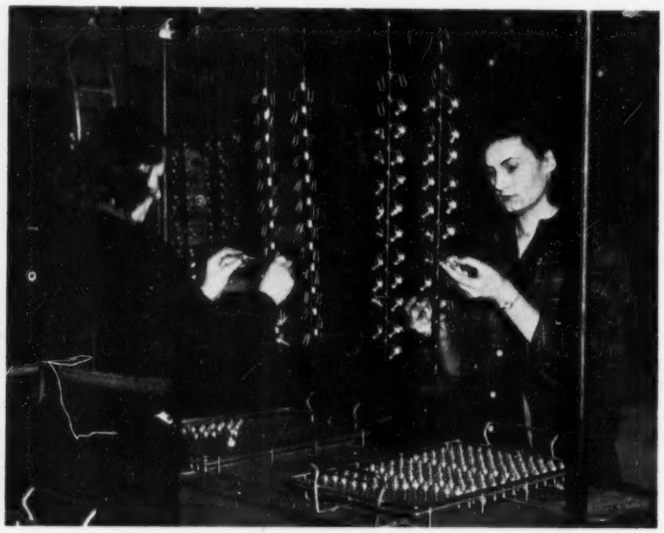
Plating Development Rapid Lately

Electroplating is an old art that has become scientific within the past 25 years. For example, commercial cadmium plating dates from 1919, receiving its first impetus through the work of Marvin J. Udy. The further development of cyanide solutions resulting in a wider bright plate range, improvements in recessed plating, new anode designs and construction, improved bath formulae and better control of plating conditions, are reflected in the Woodworth technique. Likewise, the rapid development of chromium plating is dated by its initial commercialization in 1924, and has made it possible to achieve such advantages of chromium as high resistance to atmospheric corrosion at ordinary and elevated temperatures and the high degree of hardness and wear resistance which gives chromium plating its salvaging values, its low coefficient of friction and its good reflectivity. Commercial tin plating on a volume basis from the alkaline stannate bath is but ten years old. The discovery of the cause of the rough and spongy deposition of the old tin plating baths has made tin plating a scientifically controlled process. This has made possible heavy deposits on odd-shaped and deeply recessed articles that can be produced by electrodeposition with far greater ease and accuracy.

The speed, endurance, and striking



Racking tables showing transfer conveyor.



Close-up view of racking before cadmium plating.

power of modern aircraft would not be possible except for the development of the metallurgical and heat treating processes which have given the required physical properties to new metal alloys. Such perfection of technique would not be possible had not the art of electrodeposition advanced as a science since the last war. By such plating, stripping, and stop-off, selective heat treatment can be used to achieve an infinite range of metallurgical results. Thus, electroplating has its significant place in war-winning and will make possible far greater performance, dependability, economy, lowered costs, and greater functioning efficiencies in the engines of our peacetime ahead. Electrodeposition is, therefore, a vital technical subject of particular importance in aircraft engine construction.

Case History of No. 110708

A good picture of the importance of electroplating can be gained by describing the processing of a typical Woodworth-built aircraft engine part. Let us take part No. 110708, whose blueprint definition is: "RETAINER-Shaft Thrust Bearing Rear. (Non-torque Indicator) o.d., 9.86"—i.d. 5.4"—multi-faced, flanged cylinder". This part comes in as a rough forging of AMS 6250—SAE 3312. From a rough weight of 14½ pounds, it is machined down to a finished weight of 4¼ pounds. It is given 26 operations consisting of normalizing, turning, boring, grinding, milling, burring, and polishing before it is copper plated. It is then plated with 0.0007" thickness of copper on all significant areas, except the internal oil holes.

An attendant photograph indicates the areas stopped off. A problem has always existed in providing an adequate stop-off material that would adhere and resist the high caustic concentration of the high-speed copper bath. Some practices use several coats of stop-off material and still run into difficulties. In characteristic style, Woodworth determined to whip this problem, and at heavy expense in chemical exploration and technical time, has succeeded in effecting an original solution to this problem by the development of a synthetic resin material and a special stop-off fixture. This fixture is rotated at less than 10 r.p.m. and a single coat of the stop-off material is applied with a brush to the counterbore. I feel confident that the company will favorably consider making this secret formula available to any accredited war producer.

This stop-off permits selective carburizing of the part. The counterbore is hardened; the remainder of the surface is left soft. After carburizing, hardening and being drawn, the part is then sand blasted, after which the copper is stripped. There occurs another sequence of 22 operations—drilling, turning, grinding, polishing, burring, etc. The part is then sand blasted for cadmium plating.

The sand blasting is done by hand, using a white banding sand. There is such exhaust efficiency in this sand blast booth that State Industrial Insurance inspectors stated it was unnecessary for operators to use masks or respirators. In some plants, I have seen air passed through three waters to remove silica before passing into

respirators. The hazard of silicosis is to be avoided. Most operators dislike masks and respirators, and in spite of all cautioning, tend to dispense with their use.

The part is then cadmium plated 0.0001"-0.0003". There follows a series of 18 grinding, drilling, reaming and countersinking operations including the rounding of edges, radii and polishing. The part is then ready for shipment . . . except:

The part may have been ground slightly oversize in machining. It is then returned by salvage for chromium repair. It is first plated all over with 0.0005" of copper to protect the finished ground surface. No bearing surface can receive chromium plating, such being stopped off with wax, a standard chromium stop-off.

(*Concluded on page* 206)

At right—Part 110708 is shown being removed from the chromium plating bath.

Above left—Close-up view of tank used for cadmium plating small parts.

Above right—Shows salt spray machine used to test the corrosion resistance of cadmium plated articles.

AN INTERPRETATION OF THE MECHANISM OF BRIGHT ELECTROPLATING*

By JOHN A. HENRICKS

Dept. Chem. & Met. Eng., University of Michigan, Ann Arbor, Mich.

The second class of organic nickel brighteners includes not only the aldehydes, ketones, and the aromatic amino compounds used in conjunction with the aromatic sulfonates or sulfonamides, but the embrittling brighteners, such as gum tragacanth[70] or the albuminoids.[71] Accepting Mann's[72] theory of quaternary salt formation, the organics can be defined as cationic acid inhibitors that are adsorbed by an active nickel cathode. As such, these compounds have a profound effect upon the cathode, particularly when they are, like the proteins, amino poly aryl methanes, or resinified unsaturated aldehydes, positively charged colloids. The sodium formate used in the Hinrichsen[73] bright cobalt-nickel bath is considered a member of this class, since formic acid is reduced to formaldehyde at a nickel cathode[74]. Likewise, mercaptans formed by cathodic reduction would fall into this class.

We believe that the characteristic brittle nickel deposit caused by the organic cations is eliminated by materials of the first class by precipitation in the cathode film. It is believed that these weakly dissociated bases yield an insoluble salt with the weakly dissociated sulfinic acids formed by reduction of the sulfonates, or sulfonamides, by a mass action equilibrium. In some cases this may be a co-precipitation of positive and negative colloids.

An additional characteristic of certain compounds of this class is a factor in bright nickel plating. Nitrogen bases lower the precipitation point of basic nickel salts, while thiourea and formaldehyde are reported[75] to produce organic inclusions in the deposit, presumably by precipitating undefined nickel salts in the cathode film.

* Paper presented at the 82nd General Meeting of the Electrochemical Society at Detroit and reprinted herewith with the Society's permission.

Here is the second and concluding installment of this paper. The first part appeared last month in the March issue of *Metal Finishing*.

B. Inorganic Brighteners

Three methods have been devised for the measurement of the pH and composition of the cathode film, namely, the drainage method of H. E. Haring,[76] the capillary sampling method of A. K. Graham[77] and associates, and the more recent freezing method of Abner Brenner.[78] While all three methods show the cathode film of a nickel plating bath to be more alkaline that the main body of solution, the increase is not significant, being less than a pH unit in magnitude.

We believe that, while these methods are of value, they fail to measure the determining pH factor in nickel deposition. That factor is the pH of the negative solution side of the electrical double layer. In the electrolysis of a simple solution of nickel sulfate, we would expect to find only the H^+ and Ni^{++} ions occupying the cathode side of the double layer to make it acid, and with only the OH^- and SO_4^{--} ions remaining on the solution side of the double layer, to make it alkaline. It is therefore probable that nickel ions approaching the cathode would be precipitated as the basic sulfate at the negative side of the double layer.

We used a crude method to approximate the cathode interface pH of a nickel bath: A cylindrical cathode was wrapped with filter paper and electrolyzed in a Watts bath of pH of 3.5. After an hour's electrolysis, the cathode was unwrapped and spot-tested with La Motte indicators from the section of filter paper adjacent to the cathode to the section of filter paper adjacent to the solution. The test indicated a pH gradient from 3.5 in the solution to approximately 7.0 at the cathode face. Beside the diaphragm action of the filter paper, the difference in transport number of the various ions in the bath make the method questionable and inaccurate. Nevertheless, it would appear that the cathode interface has a pH above the precipitation point of basic nickel sulfate.

While the diaphragm action of the filter paper makes the accuracy of this method doubtful, it simulates the effect of organic or inorganic colloids in the cathode film in restricting normal diffusion, and thus affecting film pH and grain growth. It will be recalled that E. A. Vuilleumier[79] was able to produce dense, smooth and satisfactory deposits of lead from an acetate bath, and silver from a nitrate bath, by coating the cathodes with glycerin or sugar solution, when, normally, these deposits would be coarse and unsatisfactory.

J. B. O'Sullivan[80] investigated nickel baths buffered with both ammonium sulfate and boric acid over a wide range of pH and was of the opinion that nickel salts were precipitated by the high pH of the cathode film where they behaved in a manner similar to organic colloids.

O'Sullivan was able to obtain bright nickel deposits at a pH of 6.4 in a borate buffered bath and at a pH of 7.0 in an ammonium sulfate buffered bath. However, his attempts to prove the existence of basic nickel inclusions by the analysis of the oxygen content of the deposit were inconsistent and inconclusive.

D. J. Macnaughtan, G. E. Gardam, R. A. F. Hammond[81] made a more thorough study of the phenomenon.

Their results indicated that no direct relationship between hardness and the amount of hydrogen discharged can be established; the suggestion previously advanced, that basic material precipitated in the liquid adjacent to the cathode face, was substantiated and elaborated. The pH at which a sharp increase in Brinell hardness occurs, with increasing pH, was termed the "critical pH" of a nickel solution, and was defined as the pH at which basic nickel salts begin to precipitate at the cathode face. In nickel sulfate solutions buffered with boric acid, ammonium and alkali metals lowered this critical pH, while fluoride and chloride raised the critical pH.

The relation between pH and the grain size of the deposit was interesting. In general, the deposits from the buffered solutions containing boric acid were matte and crystalline, while those from the unbuffered solutions tended to be lustrous or mirror bright. In a solution containing only nickel and potassium sulfates at a pH of 4.0, the deposits were almost entirely bright on a modified bent cathode made by plating a flat cathode at right angles to the plane of a single anode. In a bath containing sodium fluoride and chlorides, boric acid and nickel sulfate at a pH of 6.15, and in a bath containing nickel and ammonium sulfates and potassium chloride at a pH of 6.9, the deposits were banded and showed no crystal structure at 70 x magnification.

The precipitation of basic nickel salts at the cathode face may help to interpret the necessity of a deposition potential more negative than the reverse potential of nickel deposited from an acid bath. The deposition of nickel from its basic sulfate would require a reverse potential somewhere between that of a Ni-$NiSO_4$ and a Ni-$Ni(OH)_2$ half-cell. The high pH of the cathode layer helps to clarify the importance of boric acid in a nickel bath, since this acid buffers between the pH's of 6.0 and 7.0.

The brightening action of zinc and cadmium salts in a nickel bath is believed to be a colloid phenomenon, as well as a modification of structure by codeposition. The auxiliary metal has, in both cases, a precipitation point below that of nickel. With a rising pH gradient between the cathode face and the main body of solution, the colloid layer is thickened by the precipitation of these metals. While cobalt has a precipitation point above that of nickel, Brdicka[82] found by means of the dropping mercury cathode that cobalt was deposited from a basic cation which he formulated as Co-$(H_2O)_5OH^+$, so that the brightening action of this metal would also be of a colloid nature. In this regard it is interesting to note that we have deposited bright nickel from a Watts-type bath containing ferrous sulfate and formaldehyde, and that bright nickel can be obtained from baths containing sodium citrate and lead.[83]

Another factor may play a part in the deposition of bright nickel. It has been shown that arsenic, selenium, tellurium and sulfur are active promoters for occlusion of hydrogen and hydride formation.[84] This could tend to increase either the reduction efficiency of the nickel cathode, or the concentration of the equivalent (OH) ions on the solution side of the double layer.

While the action of any nickel brightener is complex and unpredictable, the five following methods should enable an investigator to make a quantitative evaluation of potential brightening agents:

1. The stability of the material in the plating bath should be determined in a two-compartment cell under prolonged electrolysis. In this manner deleterious products of either cathodic reduction or anodic oxidation will be revealed.

2. The oxidation-reduction potential of the prospective brightener should be determined, preferably by the dropping mercury cathode, using the intended nickel plating bath as electrolyte.

3. The value of the compound as an acid pickling inhibitor should be determined by either the weight-loss or hydrogen evolution methods.

4. The effect of the material upon the precipitation point of basic nickel salts should be determined electrometrically.

5. The effect upon the periodicity of nickel deposition should be determined by a recording cathode ray oscillograph.

By these tests it is believed that much of the previous "black magic" of brightening agents will be eliminated.

Besides increasing the specular reflection of the deposit, a strong nickel brightener produces two important and measurable changes in the nickel bath. The brightener increases the cathode polarization and increases the deposit hardness by detectable inclusions therein.

We ascribe the polarization to a resistance through the cathode film caused by a porous colloid membrane. Even when the colloids are inorganic, the membrane will offer resistance since nickel ions form a complex with such colloids regardless of their charge, which travel by cataphoresis to the cathode.[111]

Macnaughtan and his associates produced bright deposits from a high pH bath that had a Brinell hardness of 457, which was reduced to 69 by annealing.[81] This hardness they attributed to basic nickel salts included in the deposit.

The type of inclusion in the deposit is a determining factor in the mechanical properties of that deposit. While inclusions from amines or basic salts are embrittling, the inclusions from aldehydes and the sulfur-type brightener do not prevent ductility.

A strong nickel brightener could be defined as an addition agent that transforms a normal nickel deposit from a Watts bath to the type of deposit obtained from a plain, unbuffered, high pH nickel bath, in that the deposit is bright, hard, striated, and contains inclusions.

The investigator should be warned, however, that acid inhibitors *per se* are generally poisonous to a nickel bath and should be formed only under cathodic reduction.

II. BRIGHT CADMIUM PLATING

Cadmium plating is of interest because the deposition is periodic[85] and because bright deposits are obtained by using both metallic and organic brighteners of the acid inhibitor type. Like the brighteners used in nickel, those effective in cadmium plating are of diverse and unrelated chemical constitution. They include glue, casein and wool,[86] sulfite cellulose waste,[87] evaporated milk,[86] dextrin,[87] sulfonated castor oil,[88] postum[89] (a coffee substitute), and aldehyde-ammo condensation products.[90]

Since the only successful bright cadmium plating is done from the cyanide bath, the relation of complex ions to bright plating should be examined to determine their function.

Mathers,[18] Fuseya,[20] and others believe that complex ions *per se* are the

important influence in the grain size of a deposit. All metals can be considered to be deposited from complex ions when the metal is deposited from aqueous solution, since all depositing ions are hydrated.[91] The difference between a hydrated metal complex, an amine metal complex, or a cyanide metal complex is largely the difference in their free energies and the difference in the ease of the precipitation of that metal from its complex—being differences in degree, but not in kind.

We believe that deposits from complex salts are fine-grained because some reduction product, intermediate to the stable soluble complex and the deposited metal, is insoluble and exists as a colloid in the cathode film. The production of an insoluble colloid in the cathode film by electroreduction, or by precipitation by an increase of the film pH, is essential for all bright plating.

In a cyanide bath the alkali metal complex is soluble, while the intermediate heavy metal cyanide is not. Kohlschütter[92] thought that insoluble cyanides were deposited on the cathode and prevented the growth of the crystals, with which view we agree. In an amine-heavy metal complex, the bath has a pH above the normal precipitation point of that metal, so that the metal will precipitate as a hydroxide when the metal is removed from its complex. It has been previously suggested that, in the deposition of metals of the iron group which combine with or absorb hydrogen, the equivalent hydroxyl ions remain at the double layer to increase the pH to the point of precipitation of colloid basic salts bearing a positive charge.

The experimental evidence which has been submitted to establish the "complex" theory of brightening can be better applied as evidence of a precipitation of a metal salt in the cathode film rather than a deposition of complex ions.

F. C. Mathers and J. R. Kuebler[93] found that tartaric acid produced a lustrous fine-grained deposit, and metaphosphoric acid a hard and smooth deposit, from a silver nitrate-nitric acid electrolyte, which normally produces a coarse-grained deposit. Since both tartaric acid and metaphosphoric acid precipitate insoluble silver salts from silver nitrate solutions,[94] it is understandable how these anions could cause a colloid precipitate at the double layer that would reduce the grain size of the deposit by cathode interference.

G. Fuseya and K. Murata[95] extended this investigation to copper sulfate plating baths, investigating numerous carboxylic and amino acids that form complexes with this metal. By accurate methods they found appreciable weight increases over the theoretical weight of the deposit as determined by a silver coulometer in series with the bath. This weight increase was attributed to the entry of the complex into the copper deposit. As in the case of silver, copper metaphosphate is insoluble and copper tartrate very slightly soluble, so the deposit weight increase and grain-size decrease could be brought about by a precipitation and inclusion of the copper salts of these acids in the deposit.

G. Fuseya and M. Nagano[96] made a thorough study of the effect of glycine (glycocoll) in a copper sulfate bath which showed that the excess weight over the Faraday equivalent increased with increased glycine concentration, while the grain size of the deposit was decreased. It is significant, however, that this was true only of molal copper sulfate, and that the weight increase and grain refinement disappeared when free sulfuric acid was added to the bath (0.1 to 1.0 molar). Electrolysis of the copper salt of glycine yields diethylene diamine.[97] The polyethylene-polyamines are patented brighteners[98] for the copper sulfate bath and probably lower the precipitation point of copper, so that a grain-refining colloid is formed in the cathode film.

Later work by Mathers[19] did little to clarify the relation between complex ions and bright deposits, since the deposits obtained were described as poor and lusterless. Deposits from halide baths of tin, lead, arsenic, antimony, bismuth and cadmium were found to contain halide inclusions, so it was assumed that the metal deposited as the positively charged halide metal complex. We are of the opinion that these inclusions are in the form of cathodically precipitated oxychlorides of these metals, which are reported to be formed by electrolysis of the metal chloride.[99]

We will therefore assume that the grain refinement produced in a complex cyanide plating bath is the result of the repressed ionization of the metal being deposited, plus the precipitation of the heavy metal cyanide in the cathode film.

In bright cadmium plating, the most effective brightening agents are nitrogenous colloids. (Patented brighteners which have been applied commerically are tabulated below.

We have found that the most active component of the non-protein addition agents was the aldehyde fraction present in sulfite cellulose waste (goulac), the roasted molasses and bran (postum), dextrose, and furfural, which were then the most effective addition agents in commercial practice. It was found that the aldehydes are resinified by the sodium cyanide of the bath, to form a polymerized cyanhydrin of unknown structure but which is a positive nitrogenous colloid. This type of addition agent is now directly synthesized to obtain a material ten times as effective as the brighteners obtained by simply adding the equivalent aldehyde body to the plating solution. Since all previous brighteners were colloid, the information that the crystalloid aldehyde brighteners formed colloid resins in the bath clarified the brightening effect in cyanide cadmium.

Sulfonated castor oil is an interesting and non-nitrogenous cadmium brightener which requires the presence of nickel or cobalt to produce brightness. Due to the high surface activity

Patentee	*U. S. Patent*	*Brighteners*
C. H. Humphries	1,536,858	Wool and other proteins
C. M. Hoff	1,564,414	Sulfite cellulose waste
M. E. Louth and O. W. Young	1,692,240	Postum (a coffee substitute)
L. R. Westbrook	1,818,719	Naphthylamine sulfonates
G. B. Hogaboom and M. B. Diggin	1,893,368	Furfural and furfural resins
J. A. Henricks	2,085,747 to 2,085,750, incl.	Aldehyde-ammo reaction products
R. O. Hull	2,090,049	Aldehyde-ammo reaction products
S. Field and A. D. Weill	"Electroplating" p. 278 of footnote 8	Dextrose and sugars

of this material, it would be present in high concentration at the solution-metal interface. Here it could either precipitate by being salted out by the extreme alkalinity of the cathode film, or it could be precipitated as the insoluble nickel or cobalt sulfo-ricinoleate. Since alkyl sulfate esters, the heavy metal salts of which are soluble, have no brightening activity, although possessed of an equally high surface activity, we favor the latter hypothesis. In addition, sulfonated castor oil is an acid inhibitor[100] as are the proteins, aldehydes, and the aldehyde ammonias and nitriles,[101] the other successful nitrogenous brighteners.

A luster equivalent to that of the basis metal is not obtained by the use of the foregoing positive nitrogenous colloids alone. These must be augmented by a metallic brightener, or a negative colloid or organic anion, to obtain maximum reflectivity in the deposit.

Nickel and/or cobalt are the most effective metallic brighteners in a cadmium cyanide bath. While nickel is codeposited to some extent at high current densities, cobalt is not, so that the phenomenon is not one of grain refinement by alloy formation. It is suggested that the sodium nickelo- or cobalto-cyanides are dissociated by the discharge of the sodium ion and that an insoluble cadmium nickelo- or cobalto-cyanide may precipitate in the film and increase the colloidality of that film.

The fact that nickelo- and cobalto-cyanides are heavy metal precipitants makes them purification agents and would explain the reported increase in tolerance for heavy metal impurities in a cadmium cyanide bath containing nickel.[102] It is believed that the lignin sulfonates present in sulfite cellulose waste liquors have a similar function, as have aluminates, titanates and amine-carbon disulfide reaction products, such as benzo-mercaptothiazole.[103]

The brightening action of the organic anions, such as the lignin sulfonates, tannins, synthetic tannins, mercaptothiazoles, and naphthylamine sulfonates, is of only an auxiliary nature and requires the addition of a nitrogenous colloid to produce maximum brightness. This would imply that a mechanism similar to that suggested for bright nickel may occur in bright cadmium plating, that is, the precipitation of a sparingly soluble quaternary salt of an organic acid in the cathode film, or a co-precipitation of positive and negative colloids therein.

In general, cadmium deposits do not have the high mirror luster of bright nickel, so that various bright dips[104] are often relied upon.

III. BRIGHT ZINC PLATING

The following bright zinc cyanide plating baths have had commercial application:

Patentee	*U. S. Patent*	*Brighteners*
L. R. Westbrook	2,080,520	Molybdates + thiourea
J. A. Henricks	2,101,581	Ammonium thiocyanate-formaldehyde resin
V. Mattacotti	2,109,887	Polymerized methyl ethyl ketone
F. F. Oplinger	2,145,518	Sodium sulfide
Barrett and Wernlund	2 171,842	Sodium sulfide + polyvinyl alcohol
R. O. Hull	2,196,588	Gelatin + oxyheterocyclic compounds
L. R. Westbrook	2,233,500	Piperonal, etc.

The first requirement for bright zinc is a bath free from heavy metal impurities This is obtained by the use of electrolytic zinc anodes and pure materials, and is maintained by the use of sulfides in the Oplinger patent, zinc dust in the Westbrook patent, and the brightener itself in the Henricks patent, to precipitate heavy metal impurities.

It will again be noted that the successful organic brighteners—such as thioureas, thiocyanate resins, aldehydes, ketones, and proteins—are acid inhibitors as in the case of bright cadmium and bright nickel plating.

Sodium sulfide thioureas, and the thiocyanate resins may cause the precipitation of insoluble zinc compounds in the cathode film, as a part of their brightening action Maximum brightness is obtained from a zinc cyanide bath only when an organic brightener is used in conjunction with a metallic salt addition.

While numerous metals such as chromium, vanadium, manganese, nickel, cobalt, rhenium, osmium, and molybdenum are effective, only the latter is of commercial significance, due to the high price and/or instability of the other metals in the bath. Since molybdenum is alloyed in the deposit, and since the reduction products intermediate to sodium molybdate and metallic molybdenum are insoluble, we may again expect that part of the brightening action of this material is due to colloid activity in the cathode film.

Banded structures in bright zinc have not been reported, and periodicity is not believed to exist, since the precipitation of inorganic zinc salts in the cathode film would be prevented by the high sodium hydroxide content of that film, which would dissolve basic salts as zincate. However, vertical striations are produced by an excessive concentration of the thiocyanate resin brightener, indicating a localized shift in the deposition brought about by this colloid.

IV. MISCELLANEOUS BRIGHTENERS IN MISCELLANEOUS BATHS

While the three plating baths heretofore discussed are the only solutions which give a maximum bright deposit as previously defined, the same essential factor of a colloid in the cathode film is also applicable to addition agents which produce brightness to a lesser degree.

The lustrous deposits obtained in the nickel[105] or copper[98] aminepyrophosphate complex baths are believed to be due to the precipitation of basic metal salts at the cathode as the complex is fissured by electrolysis, the bath pH being above their precipitation point.

Chromium deposits are bright because of the brightening action of the colloid layer of $Cr(OH)_3CrOH\text{-}CrO_4$ formed in the cathode film by reduction. Thick chromium deposits still retain this brightness.

It is believed that carbon disulfide is effective in the silver cyanide bath both because it is added in the form of a colloid emulsion, and because it can react with the ammonia of the bath to form a dithiocarbamate, $KS\cdot CS\cdot NH_2$. Dithiocarbonates are acid inhibitors[101] and heavy metal precipitants. Egeberg and Promisel in-

vestigated various compounds and their homologs that could result from a reaction of CS_2 with the components of the silver bath and found several brightening agents[106] with the powerful C-N-S linkage which is present in numerous acid inhibitors.

The "hypo" ($Na_2S_2O_3 \cdot 5H_2O$) used in cyanide copper plating is converted to sulfite and thiocyanate by the free cyanide of the bath. Both copper salts are sparingly soluble and may cause inclusions in the copper deposit. It is believed that the smooth deposits obtained from the rochelle salt copper bath are a result of precipitation of sparingly soluble copper tartrate in the cathode film.

It is believed that the reported brightening by phenols and naphthols in acid tin[107] and acid copper[108] plating baths is due to the fact that the heavy metal phenolates and naphtholates are insoluble.

O. P. Watts and M. H. Li[109] studied the effects of numerous organic compounds upon the structure of iron deposited from the sulfate bath. The best brightener found was ammonium oxalate. The ammonium radical would tend to lower the precipitation point of iron, while iron oxalates are insoluble. Next in value was hexamethylene tetramine ("formin") which, in addition to being an acid inhibitor, would also lower the precipitation point of basic iron salts. Phenol and polyhydroxy phenols were also effective in refining the grain size of the deposit and, again, are also iron precipitants.

W. M. Phillips and F. Clifton recently presented a paper[110] describing bright copper deposited from an acid bath containing thiourea to brighten, and molasses to soften, the deposit. Both are acid inhibitors.[101] In addition, the tautomeric imide will precipitate cuprous copper as a mercaptide.

$$\begin{matrix} NH_2 \\ NH_2 \end{matrix} \Big\rangle C = S \rightleftharpoons \begin{matrix} NH \\ NH_2 \end{matrix} \Big\rangle CSH$$

When an aqueous solution of thiourea is added to the copper sulfate bath, a white precipitate is formed which redissolves with stirring. This precipitate, which is also slowly deposited from the bath on standing, is gelatinous and contains copper. It is believed that a similar material is formed by cathodic reduction, and is the active brightener in this bath.

SUMMARY

It has been pointed out that all bright plating in which the brightness is independent of the thickness of the deposit is apparently due to inorganic colloids which may be formed by: (1) basic salts precipitated by the pH rise in the cathode film; (2) insoluble salts precipitated by the electrolyte rupture of a metal complex; or (3) insoluble metal salts of a precipitating anion, working in conjunction with an adsorbed organic compound of the acid inhibitor type, which may be a colloid and which may be formed by cathodic reduction.

70. Todd and King, U. S. Pat. 1,352,328.
71. Balley, Can. Pat. 380,041 (1939).
72. See footnote 44.
73. Hinrichsen, Brit. Pat. 461,126 (1937).
74. Ellis and McElroy, U. S. Pat. 867,575.
75. Raub and Wittum, Metal Ind. (N. Y.) **38,** 208 (1940).
76. Haring, Trans. Electrochem. Soc. **41,** 351 (1922).
77. Graham and Read, Trans. Electrochem. Soc. **78,** 279 (1940).
78. Brenner, Proc. Am. Electroplaters' Soc. **29,** 28 (1941).
79. Vuilleumier, Trans. Electrochem. Soc. **50,** 229 (1926).
80. O'Sullivan, Trans. Faraday Soc. **26,** 89 (1930).
81. Macnaughtan and Hammond, Trans. Faraday Soc. **27,** 633 (1931); Macnaughtan, Hammond and Gardam, Trans. Faraday Soc. **29,** 729 (1933); ibid. **29,** 759 (1933).
82. Brdicka, Collection Czechoslov. Chem. Commun. **3,** 396 (1931); See also Fink and Lah Trans. Electrochem. Soc. **58** 373 (1930).
83. Pinner and DeWitt, U. S. Pat. 1,837,830.
84. Zapffe and Faust, Proc. Am. Electroplaters' Soc. **28,** 13 (1940).
85. Hedges, J. Chem. Soc. **130,** 1077 (1927).
86. Humphries, U. S. Pat. 1,536,858 and 1,536,859.
87. Hoff, U. S. Pat. 1,564,414.
88. Westbrook, Trans. Electrochem. Soc. **55,** 333 (1929).
89. Louth and Young, U. S. Pat. 1,692,240.
90. Henricks, U. S. Pat. 2,085,747 to 750, incl.; Vaughen, U. S. Pat. 2,085,776; Hull, U. S. Pat. 2,090,049.
91. Butler, "Electrocapillarity," p. 53. Chemical Publ. Co., New York (1940).
92. Kohlschütter, Z. Elektrochem. **19,** 181 (1913).
93. Mathers and Kuebler, Trans. Electrochem. Soc. **29,** 417 (1916).
94. Treadwell and Hall, "Analytical Chemistry," Vol. I. John Wiley & Sons, New York (1937).
95. Fuseya and Murata, Trans. Electrochem. Soc. **50,** 235 (1926).
96. Fuseya and Nagano, Trans. Electrochem. Soc. **52,** 249 (1927).
97. Libenfeld, Ger. Pat. 147,943.
98. Greenspan, U. S. Pat. 2,195,454; Stareck, U. S. Pat. 2,250.556.
99. Carrara Gazz. chim. ital. **33** I, 279 (1903).
100. Jimeno, Griffol and Morral, Trans. Electrochem. Soc. **69,** 105 (1936).
101. Pirak and Wenzel, Korrosion u. Metallschutz **10-2,** 29 (1934).
102. See footnote 91.
103. Unpublished work by author.
104. Westbrook and Soderberg, Trans. Electrochem. Soc. **80,** 438 (1941).
105. Tuttle, U. S. Pat. 2,069,566.
106. Egeberg and Promisel, Trans. Electrochem. Soc. **74,** 211 (1938).
107. Pine, Trans. Electrochem. Soc. **80,** 636 (1941).
108. Hull and Blum, Natl. Bur. Standards J. Research **5,** 767 (1930).
109. Watts and Li, Trans. Electrochem. Soc. **25,** 529 (1914).
110. Phillips and Clifton, Proc. Am. Electroplaters' Soc., 1942 (in press).

ACKNOWLEDGMENT

The helpful criticisms and suggestions offered by Professor E. M. Baker of the University of Michigan and Dr. Charles Kasper of the National Bureau of Standards are gratefully acknowledged.

(*Concluded from page* 201)

The part is then mounted in a Woodworth designed special chromium-plating fixture which is shown in a photograph herewith. The external part of the fixture is cathodic, the internal part anodic. After the copper is stripped from unprotected areas and the part is given an electrolytic cleaning, the fixture is mounted in the chromium plating tank, the cathode hook is placed on the work rod, and the anode auxiliary connecting cable is fastened to the anode circuit. It is then plated in a standard plating bath, the plating time being continued until sufficient stock has been deposited to permit 0.003"-0.005" grinding. The part is then removed from the plating tank, the stop-off is peeled off and it is then heated at 350° F. for two hours in a draw furnace. It is then copper stripped and replated with cadmium to be returned to grinding and final shipping. Thus, very valuable pieces that would otherwise be scrapped are salvaged and repaired by a simple grinding operation.

The Woodworth Laboratory

The Woodworth chemical laboratory is an air-conditioned model with complete equipment for the wide variety of daily analyses covering the complete control within narrow limits of all plating baths. This laboratory also handles all steel analyses, metallurgical characteristic tests and metallography.

Control of plating processes by periodic analyses is a "must" in modern plating practice. It is useless to attempt to control the specifications for thickness of plating or quality of deposit without checking bath composition at intervals. Difference in anode and cathode efficiencies and dragout disturb uniform composition and require checking. The analyses are relatively simple, such major constituents as metal content and any significant anion such as the free cyanide in a cyanide bath being necessarily controlled. The +5 per cent limits are usually satisfactory.

Salt spray testing apparatus is maintained by the Woodworth laboratory to make possible periodic checks on corrosion-resistance. This is particularly important because of the exposure of all aircraft engine parts to salt water conditions.

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

War Brings Changes The war is producing many changes, new ideas and new interests. For example, the three methods of applying metal surfacing and the tool tipping process, have received considerable attention because WPB orders have limited the use of surfacing and tipping materials to essential types of equipment and products and because of the scarcity of alloying elements contained in such materials.

Electroplating Take electroplating, for example. This method, which has long been used for ornamental or corrosion resisting purposes such as silver plating on flatware, gold plating on jewelry, zinc coating on wire fencing, cadmium plateing and chromium and nickel plating on automobile headlights and radiators, has been given a considerable amount of attention since the beginning of the war because it possesses many advantages over other metal surfacing methods. Electroplating is an accurate control over the thickness of metal surfacing; its application to inaccessible parts of an article are easy of accomplishment; since heat is not used, it does not warp or distort an article, and it is the only way to apply chromium to an article or part.

Spraying or Metallizing Spraying or metallizing, which was first used about 30 years ago, is another method of surfacing which is receiving considerable attention. In this process aluminum, babbits, copper, brass, bronze, cadmium, lead, Monel, nickel, tin or zinc is fed into a spray gun in which the metal is melted by a high temperature flame, atomized and sprayed by compressed air onto the part to be processed. Even though the metal leaves the gun in a melted state the metal cools so quickly after contact with base metal that there is no danger of heat distortion. This method of surfacing is especially adaptable to the coating of large surfaces, or in the surfacing of articles which can not be placed into a large vat because of their unusual shape. Spraying may not produce a flat, smooth surface, but this can be corrected by filing, grinding and polishing. Since this method leaves the article with considerable porosity, it has good bearing surface by permitting lubricants to be absorbed and retained in the minute pores.

Fusion Welding Fusion welding, more commonly called "hard surfacing," which has been developed during the past twenty-five years, is another method of applying metal surfaces which has received attention during the present international situation. This method is being used primarily to apply a coating, edge or point which will offer strong resistance to abrasion, corrosion, erosion, heat and impact.

Tool Tipping Process Tipping cutting tools with high speed steels, sintered carbides, and hard non-ferrous alloys of the stellite type which are affixed by brazing or welding (the baby of metal surfacing methods), has not been overlooked by those who wish to conserve both tools and materials.

Metal Surfacing Future While it is difficult to forecast accurately how far these four methods of metal surfacing will advance under the urge of war, nevertheless their position is as firmly established as the business of resoling shoes and veneering wood.

What About Small Business? The report of the Senate Special Committee to Study and Survey Problems of American Small Business, submitted to Congress on March 11, 1943, declared that the Smaller War Plants Act has not as yet achieved its objectives because of the indifference and opposition of procurement officials, the absence of properly co-ordinated planning of essential civilian supply and war production, and the lack of understanding of the productive capacity of small plants. It stoutly claims that free enterprise cannot be maintained if small business is destroyed. For this reason it recommended to the Smaller War Plant Corporation and to the vice chairman of the WPB in charge of small plants, that they adopt these policies: (1) the SWPC should exercise its prime contracting powers on the broadest possible basis; (2) the SWPC should use its financial power to the full; (3) all small firms capable of assuming prime contracts should be certified to the procurement agencies; (4) full advance production requirements should be obtained from all procurement agencies; (5) essential civilian production should be explored at once; (6) aggressive action should be taken to stimulate more subcontracts to small companies; (7) the formation of small business production pools should be actively encouraged; (8) an adequate field staff should be developed immediately; (9) complete and regular information should be obtained on the use of small business in war and essential civilian production; (10) the SWPC should have a voice in other functions of the WPB; (11) special studies on small business and the war program should be made, and (12) more adequate reports should be sent to the Congress on the administration of the Act.

Some Government Agencies Uneasy The curiosity, investigations, legislation and speech-making of the new Congress are making some government agencies uneasy about the future. Congress is very much concerned about the complicated manpower draft question and the problems of work or fight orders, post-war planning, taxes, governmental economy, the rights of labor, and industrial absenteeism.

Absenteeism Causes Army and Navy officials and Congress are disturbed over absenteeism for the reason that reports are coming in from all parts of the United States which indicate clearly that it is constantly increasing. As a result some armed force officials are urging legislation which would not only keep workers on the job but also require employers to keep attendance records of draft deferred workers to show that they are not chronic absentees. Voluntary absences are said to be caused by lack of worker interest; because money is not needed; because the workers want to go shopping, fishing or to a movie; because the workers are restless due to unsatisfied wants caused by the war or because the war has caused changes in normal food, shelter and clothing habits. Voluntary absences of women are due to required household duties, child care and shopping. On the other hand, involuntary absences are said to arise from inadequate transportation and housing facilities, improper eating facilities in both plants and in industrial towns, greater fatigue due to a longer work week; disablement caused by illnesses and injuries; inability of older workers to stand up under the strain of harder work and longer hours; disrupted delivery schedules causing the plant to wait for materials and supplies, and some plants' practice of hoarding labor.

Aluminum End-Products Order Amended All firms which received CMP allotments of aluminum are permitted to use this metal only for specified group end-products such as *anodizing equipment for electrical conducting parts coming into contact with the solution only*, according to Aluminum Supplementary Order M-1-i, as amended March 10, 1943. Persons desiring specific permission to use aluminum for purposes not authorized by this amended order must apply by letter to the Aluminum and Magnesium Division of the WPB and give full details on the projected use and need for the metal.

Antimony Restriction Eased Restrictions on the use of antimony in the production of automotive batteries and alloys were removed and the weight limit for small deliveries of antimony to any one person was substantially increased in General Preference Order M-112, as amended March 8, 1943. The restrictions of the original order as they apply to the antimony content of *inorganic pigments*, toys, decorative objects, and ornaments were not changed. The permissible amount of unallocated deliveries of antimony to individual customers has been raised from 25 pounds to 2,240 pounds per month. The amended order has also lifted the ban on the use of antimony in *white pigments, opacifiers, and frits for non-acid-resisting ceramic enamels.*

Automotive Copper Parts Restricted Further The use of copper and copper base alloy products in the manufacture of automotive parts was restricted further in Limitation Order L-106, as amended March 4, 1943. The purpose of this extension is to reduce the amount of copper and copper base alloy products used in the manufacture of such exempted articles as radiators, cooling system control devices, electric equipment, tubing, tube fittings and actuating parts, bearings, bushings, thrust washers, carburetors, fuel pump parts, *electroplating*, gaskets, transmissions, brazing materials, powdered copper, clutch facings, brake linings, speedometers, tachometers, heat indicators, and oil gauges.

Baltimore-Washington Platers Meeting At the March 6, 1943 meeting of the Baltimore-Washington Branch of the American Electroplaters' Society, held in Baltimore, Mr. R. P. Crane, vice president of the Lea Manufacturing Company, Waterbury, Conn., delivered an address on "Burring and Its Application to the War Program". This address was a timely and informative contribution because strict government specifications, which demand an absolute minimum in friction, have made it necessary for production and process engineers to determine burring methods which provide for desired results, production, and precision. In his speech, Mr. Crane dealt with rolling and tumbling, polishing wheels and their accessories, rotary files, abrasive belts and discs, sand blasting, wire wheels, Tampico brushes, abrasive points including abrasive impregnated rubber mounted in flexible power tools, and other methods.

Cadmium Plating Recommended At the February 26, 1943 meeting of the Industrial Advisory Committee on radio variable condensers, it was suggested that the specifications be changed from the present requirement of *silver plating* to *cadmium plating*. This recommendation was made because the armed services' salt spray tests revealed that silver turns to silver chloride, whereas cadmium plating does not undergo any change from salt spray.

Class A & B Product Deliveries The conditions under which delivery orders for Class A and Class B and other products must be refused were set forth in CMP Regulation No. 1 as amended on February 27, 1943. This amended regulation stipulates that no manufacturer is permitted to accept an allotment for the making of Class A products, regardless of the accompanying preference rating, if he cannot fulfill the related authorized production schedule. And when he accepts an allotment and authorized production schedule for a Class A product, he is not permitted to accept another delivery order, except one bearing a rating of AAA, if its filling will interfere with the previously accepted schedule. On the other hand, a manufacturer who is producing Class B products to fill unrated or low rated orders must accept higher rated orders, as provided in Priorities Regulation No. 1, unless he is also making Class A products on an authorized production schedule.

CMP Regulation No. 1 Interpretation Interpretation No. 1 on CMP Regulation No. 1 which was issued on March 8, 1943 states: "Questions has arisen as to what constitutes discrimination between customers within the meaning of paragraph (s) (4) and (t) (2) (i) of CMP Regulation No. 1. These provisions prohibit producers of controlled materials from discrimination between customers in rejecting or accepting orders which are filed later than the prescribed time or which call for deliveries of less than the minimum mill quantities. These provisions mean that, in similar situations, different customers must receive similar treatment. A controlled materials producer who has rejected a late order or a small order from one customer, is not prohibited from accepting such an order from another customer if the difference in treatment of the two orders is based in good faith on differences in the practicability of filling the orders in view of the nature of the material ordered, the condition of the production schedule at the time the orders are received, or similar factors."

CMP Regulation No. 7 Issued CMP Regulation No. 7, issued on March 2, 1943, has simplified Controlled Materials Plan procedure. This regulation provides for a single standard form of certification which may be placed on any delivery order, in lieu of one or more of the other forms which are required in varying circumstances by CMP Regulations 3, 4 and 5. In other words, this new standard form will eliminate the necessity of placing several different certifications on a single order.

CMP Regulation No. 8 Issued The issuance of Controlled Materials Plan Regulation No. 8 on March 13, 1943 established the procedure under which controlled materials producers will obtain materials required for their products. Allotments of controlled materials will be made to producers in the same manner as allotments for the manufacturer of Class A and Class B products. The new regulation provides a preference rating of AA-1 and an allotment symbol, X-1, which may be applied to purchase orders for other than controlled materials by those controlled materials producers who apply for and receive specific authorization to operate under the regulation's terms. The regulation, among other things, provides that "an authorized controlled order shall not constitute an allotment of controlled materials to the controlled materials producer with whom it is placed, but such order shall be filled in the manner provided in CMP Regulation No. 1."

CMP Consumer Allotment Accounting Manual The Distribution Bureau of the Controller Division of the WPB issued a pamphlet on February 26, 1943 called "Controlled Materials Plan Consumer Allotment Accounting Manual." This manual does not aim to alter or change the principles of keeping records and accounting, but it is full of helpful suggestions, illustrated with forms, on how to keep the records required under the Controlled Materials Plan. Readers of METAL FINISHING should get a copy from their local WPB office.

Copper for Insignia Restricted The use of copper material for armed service insignia and apparel was restricted in Copper M-9-c, as amended February 25, 1943, but this restriction will not affect the production of bronze medals for servicemen cited for bravery or efficiency. Producers of such medals will be permitted to manufacture them on purchase orders rated AA-3 or higher. The amended order restricts the use of copper and copper material for bells except under certain conditions. Restriction on the use of copper in locks was relaxed to permit the manufacture of small parts for disc tumblers and secure lever locks. The restrictions on the use of copper in health supplies and in air conditioning and refrigerating equipment were altered to conform more closely with the provisions of other WPB orders. Ferrules—fittings necessary for use with galvanized or lead pipes—were included among the permitted articles for water supply and distribution systems.

Copper Scrap Salvage Problem Hamilton W. Wright, chief of the WPB's Industrial Salvage Branch, recently told his regional chiefs that copper scrap is the number one industrial salvage problem. He said that industrial salvage must produce a large quantity of scrap to keep the copper and aluminum plants at peak production during 1943.

Form CMP-4A Simplified Manufacturers of Class A products under the Controlled Materials Plan may now apply for their allotments of aluminum, copper and steel on one of the simplest government forms yet designed. Form CMP-4A which was formerly a four-page application, has been reduced to a single letter-sized page. Form CMP-4B, at this writing, is in the process of similar simplification.

Heat Exchangers Authorization Form Revised Prospective buyers of heat exchangers, which are controlled by General Limitation Order L-172, must now apply for authorization to purchase on form, Revised PD-615. This new form requires complete information regarding the delivery promises made by manufacturers in order to determine definite delivery dates. This simplified form combines the functions of the two previous forms required—PD-615 and PD-615A.

Hellige Taken Over by Government Alien Property Custodian Leon T. Crowley on March, 11, 1943 took over the direction, management, and supervision of Hellige, Inc. of Long Island City, N. Y. This firm, which manufactures scientific laboratory supplies, is now making water testers for the United States Army. The firm's business will be carried on by the Office of Alien Property Custodian with the help of Army technicians.

Imported Industrial Wax Prices All forms of imported industrial waxes, including beeswax, used to waterproof tarpaulins, tenting, gas masks, airplane fabrics, and as coating for artillery shells, were placed under Maximum Price Regulation No. 264 by Amendment No. 1 issued on February 27, 1943. The prices on crude candelilla wax were fixed at from 34.3 to 36.05 cents a pound; the fixed ouricury wax prices range from 48.50 to 68.00 cents a pound, and the established crude imported beeswax prices range from 37.50 to 44.75 cents a pound.

Lead Coatings Urged Under the new specifications set out in Schedule III of Limitation Order L-211, as amended March 2, 1943, two-point barbed wire may now be made in two styles, while four-point wire can be made in one style. This amended order restricts the *galvanizing of wire* by limiting the use of zinc coating or the weights established by Federal specifications, as outlined in the schedule. Producers are urged to use *lead coatings* instead of *zinc coatings* wherever possible.

Limitation of Inventory Booklet Readers of METAL FINISHING should secure for themselves a copy of the WPB booklet entitled "Limitation of Inventory" which is a graphic explanation of Inventory Limitation Order L-219. This booklet gives the how, when, who and why on inventory limitation. It is illustrated with inventory forms; and it gives a lot of other useful information on the order. Copies can be obtained from the local WPB office.

Limitation Order L-123 Restrictions Eased Certificates of exemption from restrictions need no longer accompany purchase orders for certain repair and maintenance parts of industrial equipment, according to Limitation Order L-123, as amended February 27, 1943, provided the part, or parts, does not exceed $1,000 in value. The amendment has eliminated from List A such equipment as industrial fans and blowers, mechanically operated pumps, industrial hand trucks, passenger and freight elevators, electric motors of one horsepower and over, and ¾ K.W. motor generator sets. The list adds electric motors rated at less than one horsepower.

Measuring Instrument Control Tightened By General Preference Order E-9, dated March 10, 1943, distribution and production control were tightened on certain precision measuring instruments and testing machines such as bench centers, comparators, dividing machines, gauging machines, *hardness testers*, light wave measuring instruments and devices, measuring machines, and *surface measuring instruments*. Order E-9, which supersedes E-5 and E-1-b with respect to the items named in Schedule A, provides that purchase orders are restricted to those with a rating of A-1-a or higher. When requested to do so, producers must file notification of all unfilled orders and proposed delivery schedules on Form PD-669. Form PD-670 must be used for shipments and changes in orders previously reported.

Mineral Access Roads Advanced It was disclosed by Commissioner Thomas H. MacDonald of the Public Roads Administration of the Federal Works Agency that on March 1, 1943, more than 2,850 miles of access roads to forests, quarries, and mines, at a cost of $9,000,000, had been approved for construction. Some of these roads will make accessible such materials as chromium, antimony, bauxite, beryl, calcite, cobalt, copper, garnet abrasive, graphite, lead, magnesite, mercury, mica, nickel, and zinc.

New Machine Tool Scheduling Method General Preference Order E-1-b, as amended March 8, 1943, established a new method of scheduling deliveries of machine tools such as *buffing machines*, filing machines, *polishers*, and about fifty other types of machine tools. Under the amended order, deliveries of machine tools are determined on the basis of backlogs, urgency of standing of each contractor, and the required delivery dates on orders for specified sizes and types.

Non-Profit Service Charges Business firms which provided non-profit accommodation service with the sale of their goods in March, 1942, are permitted to charge an amount aggregating the current cost of direct labor and materials for such service, according to OPA Supplementary Order 38, dated March, 9, 1943. This permission was granted because of the increases in wage scales and in the ceiling prices of some materials.

Over-seas Packing Booklet Issued A booklet on "Army-Navy General Specifications for Packing and Packing for Over-seas Shipments", which was prepared by the WPB Container Coordinating Committee with the cooperation of the government agencies, was made available for distribution to manufacturers and shippers engaged in war work. This booklet gives special attention on how to provide adequate protection against corrosion and moisture of machine parts so that delicate instruments may be assembled and operated satisfactorily in the quickest possible time after unpacking. METAL FINISHING readers should get a copy of this booklet from their local WPB office.

Priorities Regulation No. 11 Amended Priorities Regulation No. 11 was amended on February 20, 1943, to bring its definitions of the terms maintenance, operating and operating supplies into conformity with those in CMP Regulation No. 5. This amendment excluded from its definitions fabricated containers, stationery supplies, office machinery and equipment, fuel and electric power, asbestos and safety clothing and gloves, *production materials*, and materials for plant construction or expansion.

Radio Rectifier Tube Control The distribution, production and sale of radio rectifier tubes were placed under control by the issuance of General Limitation Order L-264 on March 10, 1943. Through the issuance of this order, it is expected that seven tons of copper-base alloy will be saved per annum on screw-bases. The manufacturers of screw-bases, similar to those for incandescent lamps, are limited to the use of iron and steel with the exception of *copper, copper base alloys, and zinc in protective coatings* or in fulfilment of military exemption orders. Brass may be used only in eyelets and pins.

Rice Made Unit Chief Charles A. Rice, president of Oxo-seal Company of Vancouver, British Columbia, was appointed a unit chief of the Electroplating and Anodizing Equipment Section, Welding and Electroplating Branch, General Industrial Equipment Division of the WPB. Mr. Rice, an American citizen, was connected at one time with Willys-Knight Motor Car Company. In his new position he will act as an assistant to W. W. McCord.

Telephone Orders and Ratings Priorities Regulation No. 3, as amended March 9, 1943, simplifies further the application of preference ratings to telephone and telegraphic orders for scarce materials. In placing an order by telegram the buyer is now permitted to use the phrase "ratings certified" instead of the ten word form of certification which was formerly required. "The requirements for manual signature or authorization under Priorities Regulation No. 7 will be satisfied in such case if the copy of the outgoing telegram retained by the person placing the order is signed or authorized in the manner provided in that regulation." In placing an order by telephone which requires shipment within seven days, the buyer must state to the supplier the substance of the certification. The one giving the order by telephone must be a duly authorized official and he must furnish the supplier, within 15 days, with a written purchase order bearing a certificate of such preference rating.

WPB Regional Offices Powers Increased The decentralization policy of the WPB has constantly increased the functions of its 12 regional offices and 131 district offices located throughout the United States. For example, since March 1, 1943, applications for priority assistance on form PD-1A are filed with the local offices. Since March 15, 1943, these offices have been empowered to assign ratings on PD-1A certificates for delivery of materials valued at $100 or less. With the passing of time, this value limitation will be increased. And since March 8, 1943, the regional offices have been empowered to authorize construction under Conservation Order L-41 and to assign preference ratings to deliveries of necessary scarce materials for building operations costing less than $10,000, except for industrial and certain other listed types of constructions.

WPB Electroplating Directory For the benefit of the electroplaters, a list of WPB administrators of special interest to them is presented here. All of these WPB administrators are located in Washington, D. C.

CONSERVATION DIVISION, *Conservation and Substitution Branch*

DR. A. KENNETH GRAHAM
Chief, Non-Metallic Section, and Head Industrial Specialist on Plating and Finishing.

GEORGE B. HOGABOOM, SR.
Principal Industrial Specialist on Plating and Finishing.

GENERAL INDUSTRIAL EQUIPMENT DIVISION

W. W. MCCORD
Chief, Electroplating and Anodizing Equipment Section.

CHARLES A. RICE
Unit Chief, Electroplating and Anodizing Equipment Section.

SERVICE EQUIPMENT DIVISION, *Repair Shops and General Services Section*

D. M. CRIM
Chief, Repair Shops and General Services Section.

C. B. GRIFFITH
Deputy Chief, Repair Shops and General Services Section.

JOHN J. BOGNAR
Senior Industrial Specialist, Electroplaters, Galvanizers and other Metal Coaters.

Cadmium Plating

By GILBERT TRAMER

Chemical Engineer,

J. J. Siefen Co., Detroit, Mich.

WITH cadmium becoming increasingly more critical to the plating industry, this article is written with the thought of conserving this metal by suggesting and reviewing two distinct types of cadmium plating baths.

The usual practice is to build a cadmium plating solution to the following formula:

Cadmium as metal—3 to 4 oz./gal.
Total sodium cyanide—12 " "

The ratio of sodium cyanide to cadmium is generally 3 or 4 to 1.

Recent observations and tests have shown the following formula to be of decided value:

Cadmium as metal . . 1½ to 2 oz./gal.
Total sodium cyanide 18 to 19 " "
Caustic soda . . . . . ½ to 1½ " "

Brighteners can be added in usual recommended quantities.

This solution, although not entirely new to platers, seems to be in practically negligible use. Starting a new cadmium bath and maintaining it within these limits will aid in the conservation of cadmium in the following manner:

1. The initial requirements of a new bath will involve only one-half the quantity of cadmium.
2. The dragout of cadmium will correspondingly be one-half because of the lower cadmium content.
3. This is the most important observation of this latter bath. With numerous specifications of 0.0002" thickness on the inside of tubes, cones, and various recessed parts, it has been necessary to plate 0.0005 to 0.0007" thickness on the outside in order to get the 0.0002" inside and in the deeply recessed parts. With the suggested formula, in order to put 0.0002" inside, it has been found that the outside or protruding sections are only coated to approximately 0.0003" to 0.0004". This, therefore, saves an approximate thickness of 0.0002" where the specifications do not require it. In addition, it also follows that the length of time in the plating bath is decreased in the neighborhood of 10 minutes when work of this type is to be plated.

In using this suggested bath, the minimum of 11 volts in a barrel and 2 volts in a still tank should be observed. Usual current densities should be adhered to although higher densities can be used depending upon the work to be plated.

With the limits of 1½ to 2 ounces per gallon of cadmium as metal to be strictly observed, it may be necessary to remove the cadmium anodes and replace with steel plates or remove the cadmium from the anode containers and use the containers as anodes.

If the metal builds up above 2 ounces per gallon, the operator will immediately notice a decrease in the throwing power of the solution. This is a characteristic reaction of this solution.

As previously stated, this solution is not new to many plating technicians, but the use of this bath seems to have been neglected and it is the feeling of the writer that it may be well worth consideration in order to conserve this critical metal.

Physical and Chemical Data on Both Solutions

Tests were conducted on the following solutions prepared with technical grade chemicals:

Solution No. 1:

Sodium cyanide	18	oz./gal.
Caustic soda	½	" "
Cadmium oxide	2	" "

Solution No. 2:

Sodium cyanide	12	oz./gal.
Cadmium oxide	3½	" "

Resistivity at 25° C. (77° F.)

Solution No. 1:—4.66 ohm.-cm.
Solution No. 2:—6.37 ohm.-cm.

Measurements were made using the standard type conductivity cell with KCl solution.

It will be noted that the resistance of Solution No. 1 is about ¾ that of Solution No. 2.

Surface Tension.

Measurements were made by the Du Nouy Method and were as follows:

Solution No. 1:—46.2 dynes/cm.
Solution No. 2:—43.9 dynes/cm.

Specific Gravity.

Measurements were made with a hydrometer at 68° F. and were as follows:

Solution No. 1:—1.80
Solution No. 2:—1.62

Anode and Cathode Efficiencies.

The technique used comprised connecting solutions No. 1 and No. 2 and a copper coulometer in series and then weighing loss of anodes and gain in cathodes after passage of current. The current was determined with the copper coulometer which contained 150 grams per liter of $CuSO_4 \cdot 5H_2O$, and 60 grams per liter of H_2SO_4. By connecting a variable resistance in the circuit, efficiencies were determined at different current densities. All solutions were at room temperature.

Solution No. 1:—
Anode efficiency—Practically 100%.
Cathode efficiency—66%.

Solution No. 2:—
Anode efficiency—Practically 100%.
Cathode efficiency—93%.

This run was conducted without stirring or agitation of the solutions and at a current density of approximately 20 amperes per square foot.

The second test was conducted under the same condition as described above, except that the solutions were stirred with a fairly rapid laboratory stirrer placed so that they were stirred continuously with equal vigor on both anode and cathode, and at the same distance from the top of each solution.

Solution No. 1:—
Anode efficiency—Practically 100%.
Cathode efficiency—98%.

Solution No. 2:—
Anode efficiency—Practically 100%.
Cathode efficiency—96%.

The third test was made with current densities of approximately 40 amperes per square foot, other conditions being the same as in the previous test.

Solution No. 1:—
Anode efficiency—Practically 100%.
Cathode efficiency—91%.

Solution No. 2:—
Anode efficiency—Practically 100%.
Cathode efficiency—83%.

From cathode efficiencies reported, it is inferred that if efficient solution agitation is observed the efficiencies of Solution No. 1 and Solution No. 2 are comparable, with somewhat better results being obtained from the former at higher current densities. It is also indicated that better efficiencies are obtained under the same conditions when good solution agitation is practiced. If, however, agitation is not observed, the anode efficiencies at lower current densities, of Solution No. 1 are somewhat lower than those of Solution No. 2.

Acknowledgment is made for the use of the chemical laboratories at Case School of Applied Sciences in Cleveland, Ohio, in which these data were assembled, and for the helpful suggestions and aid of Drs. Arnold and Maron and Mr. Gable of the Chemical Department of Case.

The Use of "Cuprodine" as a Lubricant in the Drawing of Steel Cartridges

By G. S. GARDNER

American Chemical Paint Co., Ambler, Pa.

IN THE manufacture of small arms and artillery cartridge cases from steel, which is now being carried out on a large scale, considerable quantities of copper are being conserved for the most necessary war uses. Many difficulties have been encountered in the drawing operations, most of which have now been successfully overcome. Among those difficulties were scratches which lead to firing failures, actual breakage in drawing, metal pickup by punches and excessive die wear. Due to the current shortage of tool makers and die stock, the question of die life is of the utmost importance.

For a considerable number of years, the wire industries have used copper as a drawing medium. Copper sulfate solutions were used to apply copper coatings by immersion, thus obviating the use of electric current. However, a more efficient process has been developed and for the past five years has been widely used in wire drawing. By its use a much better immersion copper coating can be obtained than was possible by the use of copper sulfate solutions. The wire so treated withstands many more drafts than when coated with the usual acid copper solution.

It seemed a logical development to apply this new process, which had been so satisfactory in the wire mills, to the drawing operations on steel cartridge cases. This proved to be unusually successful. It made unnecessary extensive installations of electroplating equipment, now almost unobtainable, and proved to be exceptionally well adapted to large scale continuous production. Best data available at the present time indicate that it has increased die life from five to ten times that obtained without its use.

Although the material itself contains copper the process is very definitely a means of *conserving* copper. For example, a steel case drawn by means of "Cuprodine" will have used less than 1% of the copper present in a brass case of the same size; otherwise stated, it saves copper to the extent of about 140 times its own copper content.

The requirements for good results with the process are few: The metal must be clean prior to application of the coating—grease, rust, and scale must be absent.

Operation of Process

A typical process applied to steel cups after drawing takes the following steps:

1. Alkali clean.
2. Anneal for 30 minutes at 1300° F.
3. Pickle and rinse thoroughly in running water.
4. Immerse for 3 minutes in a solution containing 4 oz. "Cuprodine"/gal. of 3% by volume of 66° sulfuric acid at a temperature of 130° F.
5. Rinse in cold running water.
6. Rinse in hot water containing 10 lb./100 gal. of neutral soap.
7. Drying is accomplished by means of heat.

This typical procedure can be subjected to a number of variations. The temperature of the treating solution can vary from room temperature to 150° F. and the time should be determined in actual operation from the results obtained in drawing.

Pickling and coating baths are maintained at optimum concentrations by regular additions of acid or "Cuprodine." These constituents of the solutions are determined by easily performed titrations which can be carried out by the workmen on the job.

Treating tanks are constructed of sheet lead or of lead-lined steel; however, wood might be used.

All the operations carried out in connection with the coating process are improved by proper agitation. Apparatus of the continuous type are very satisfactory for all the operations.

The copper coatings are thin and will vary from 0.00002-0.00005" in thickness. Like all copper coatings, their rust resistance is limited, although their stability is ample for drawing and forming operations. Coatings obtained by the process are very adherent. They have frequently been found to be even more adherent than electrodeposited coatings.

While at the present time this process has been adopted generally in the drawing of cartridge cases for small arms ammunition, the same type problems are present in the drawing of artillery shell cases. The advantages of marked increase in die life, reduction in metal pickup, and improved drawing, which have been demonstrated, seem to offer possibilities for improving the results obtained in the production of artillery ammunition.

Dictionary of Metal Finishing Chemicals

Bismuth Oxychloride: BiOCl. Mol. wt. 260.46. Sp. gr. 7.7. Fine, crystalline, white powder. Also known as Bismuth Subchloride, Pearl White. Insoluble in water. Soluble in acids. Grades: Technical, Purified, C. P. Containers: Bottles; Cartons (1, 5 lb.); Cans (25 lb.); Kegs (100 lb.).

Bismuth Subcarbonate: $Bi_2O_3CO_2 \cdot H_2O$. Mol. wt. 528.03. Sp. gr. 6.86. White powder. Also known as Bismuth Oxycarbonate and Bismuth Carbonate. Decomposes when heated. Insoluble in water. Soluble in acids. Grades: Technical, U. S. P., C. P. Containers: Bottles; Cartons; Tins (1, 5 lb.); Kegs (25 lb.); Cans.

Bismuth Subchloride: See Bismuth Oxychloride.

Bismuth Subnitrate: $BiONO_3 \cdot H_2O$. Mol. wt. 305.02. Sp. gr. 4.928. Hexagonal plates or white powder. Also known as Basic Bismuth Nitrate, Spanish White. Decomposes when heated. Insoluble in water. Soluble in acids. Grades: Technical, U. S. P., C. P. Containers: Bottles, Cartons, Tins (1, 5 lb.); Cans (25, 50 lb.); Drums (25, 100 lb.); Barrels (250 lb.).

Bismuth Trichloride: See Bismuth Chloride.

Bismuth Trinitrate: See Bismuth Nitrate.

Bismuth Trioxide: Bi_2O_3. Mol. wt. 466.00. Sp. gr. 8.9. M. P. 820° C. Yellow powder. Also known as Bismuth Oxide. Insoluble in water. Soluble in acids. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Cans (25, 50 lb.).

Bitumen: The group of hydrocarbons soluble in carbon disulfide. See Asphalt.

Black Lead: See Graphite.

Blanc Fixe: See Barium Sulfate.

Bleaching Powder: See Calcium Hypochlorite.

Block Tin: Common name for pure tin.

Blue Copperas: See Copper Sulfate.

Blue Powder: See Zinc.

Bluestone: See Copper Sulfate.

Blue Verdigris: See Copper Acetate, Basic.

Metal Finishing **continues the dictionary of chemicals particularly applicable to its industry with this, the fourth installment.**

This will be a regular monthly feature of *Metal Finishing* until it is complete from A through Z.

Blue Vitriol: See Copper Sulfate.

Bone Ash: Fine or coarse yellowish-white powder containing 67-85% tribasic calcium phosphate, 2-3% magnesium phosphate, 3-10% calcium carbonate, calcium oxide and calcium fluoride in small amounts. Also known as Bone Earth. Grades: Technical. Containers: Cartons (1, 5, 10, 25, 50 lb.); Kegs (100 lb.); Barrels (250, 350, 375 lb.).

Bone Earth: See Bone Ash.

Boracic Acid: See Boric Acid.

Borax: Natural sodium borate, q. v.

Borax, Burnt: Sodium borate which has been calcined to remove most of the water of crystallization. Also known as Calcined Borax.

Borax, Calcined: See Borax, Burnt.

Borax Glass: See Sodium Borate, Fused.

Boric Acid: H_3BO_3. Mol. wt. 61.84. Sp. gr. 1.435. M. P. 185°C. (with some decomposition). White crystals, powder or spangles. Also known as Boracic Acid and Orthoboric Acid. Solubility, 1.95 at 0° and 39.1 at 100° C. Soluble in glycerine and alcohol. Grades: Technical, U. S. P., C. P., crystal, powder, impalpable powder. Containers: Bottles, Cartons (1, 5 lb.); Boxes, Cans (25, 50 lb.); Bags, Kegs, Drums (100 lb.); Barrels (175, 300, 325 lb.).

Boric Acid-Ortho: See Boric Acid.

Borolon: Brand of aluminum oxide abrasive.

Boron: B. At. wt. 10.82. Sp. gr. 2.54 M. P. 2300°C. Brown, amorphous powder or monoclinic, yellow crystals. Insoluble in water. Soluble in nitric acid and sulfuric acid. Grades: Technical. Containers: Bottles (1, 10 g.); Iron drums.

Brazil Wax: See Carnauba Wax.

Brimstone: See Sulfur.

Brimstone Acid: This is an iron and arsenic-free sulfuric acid prepared from elemental sulfur. See Sulfuric Acid.

Bromine: Br_2. Mol. wt. 159.832. Sp. gr. 2.93. M. P. —7.3° C. B. P. 58.78° C. Dark red liquid; very irritating. Solubility, 4.2 at 0°C. and 3.5 at 50° C. Very soluble in alcohol, chloroform, ether, carbon disulfide. Grades: Technical, N. F., U. S. P., C. P. Containers: Ampules (1 lb.); Bottles (1, 6.5 lb.).

Bromine Water: Solution of 3.2 grams of bromine in 100 grams of water.

Burgundy Pitch: A reddish brown or yellow resin obtained from Norway spruce or European silver fir. Brittle and opaque. Often imitated by using a mixture of ordinary pitch, rosin and turpentine agitated with water.

Burnt Alum: Aluminum ammonium sulfate or aluminum potassium sulfate heated to drive off the water of crystallization.

Burnt Lime: See Calcium Oxide.

Butanol: See Butyl Alcohol, Normal.

Butter of Antimony: See Antimony Chloride.

Butter of Arsenic: See Arsenic Chloride.

Butter of Tin: See Stannic Chloride.

Button Lac: See Shellac.

Butyl Acetate: $CH_3CO_2C_4H_9$. Mol. wt. 116.156. Sp. gr. 0.872. B. P. 125.1° C. Colorless, inflammable liquid. Slightly soluble in water. Soluble in hydrocarbons, alcohol, ether. Grades: Technical, Purified. Containers: Bottles (1 lb.); Cans (1 pint, 1 gal.); Drums (50, 100 gal.); Tank cars.

Butyl Alcohol Normal: $CH_3(CH_2)_2CH_2OH$. Mol. wt. 74.120. Sp. gr. 0.8098. B. P. 117.7° C. Colorless liquid. Also known as Butanol, Butyric Alcohol. Solubility, 7.9 at 20°C. Infinitely soluble in alcohol, ether. Grades: Technical, C. P. Containers: Bottles (1 lb.); Cans (1, 5 gal.); Drums (50, 100 gal.); Tank cars.

Butyric Alcohol: See Butyl Alcohol, Normal.

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity: M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Cadmium: Cd. At. wt. 112.41. Sp. gr. 8.65. M. P. 321°C. B. P. 767°C. Silver white metal. Insoluble in water. Soluble in acids, ammonium nitrate solutions. Grades: Technical, C. P., Mossy, Sticks, Rods, Balls, Powder, Slabs. Containers: Cans (1, 5 lb.); Cases.

Cadmium Carbonate: $CdCO_3$. Mol. wt. 172.42. Sp. gr. 4.26. Trigonal white crystals or white powder. Decomposes below 500°C. Insoluble in water. Soluble in acids, cyanides and solutions of ammonium salts. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Cans (25 lb.).

Cadmium Chloride: $CdCl_2 \cdot 2H_2O$. Mol. wt. 219.36. Sp. gr. 3.33. Small, white crystals. Very soluble in water. Slightly soluble in alcohol. Grades: Technical, C. P., Purified. Containers: Bottles, (1, 5 lb.); Tins; Kegs (10, 25, 50, 100 lb.); Jars (25 lb.); Drums (100 lb.); Barrels (250 lb.).

Cadmium Chloride, Anhydrous: $CdCl_2$. Mol. wt. 183.32. Sp. gr. 4.05. M. P. 568°C. Small, colorless crystals or white crystalline powder. Solubility, 140 at 20°C. and 150 at 100°C. Very slightly soluble in alcohol. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Tins; Kegs.

Cadmium Cyanide: $Cd(CN)_2$. Mol. wt. 164.45. White crystalline powder. Decomposes when heated above 200° C. Very slightly soluble in water. Soluble in cyanide solutions, acids, ammonium hydroxide. Grades: Technical, Purified. Containers: Bottles (1 lb.).

Cadmium Ferrocyanide: $Cd_2Fe(CN)_6$. Mol. wt. 436.78. White powder. Insoluble in water and in dilute hydrochloric acid.

Cadmium Hydrate: See Cadmium Hydroxide.

Cadmium Hydroxide: $Cd(OH)_2$. Mol. wt. 146.43. Sp. gr. 4.79. Microscopic white crystals or amorphous white powder. Also known as Cadmium Hydrate. Decomposes when heated. Insoluble in water. Soluble in acids and ammonium salts. Insoluble in alkalis. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Tins (10 lb.); Kegs (25, 50, 100 lb.); Barrels (250 lb.).

Cadmium Nitrate: $Cd(NO_3)_2 \cdot 4H_2O$. Mol. wt. 308.49. Sp. gr. 2.46. Prismatic white hygroscopic needles. Solubility, 110 at 0°C. and 326 at 60° C. Insoluble in nitric acid. Soluble in alcohol. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Tins.

Cadmium Orange: See Cadmium Sulfide.

Cadmium Oxide: CdO. Mol. wt. 128.41. Sp. gr. 6.95. Reddish brown amorphous powder. Insoluble in water. Soluble in acids, ammonium salts, cyanide solutions. Insoluble in alkalis. Grades: Technical, C. P. Containers: Bottles, Cans (1, 5 lb.); Tins (10, 25, 50 lb.); Kegs (25, 50, 100 lb.); Boxes (50 lb.); Barrels (250 lb.).

Cadmium Sulfate: $3CdSO_4 \cdot 8H_2O$. Mol. wt. 769.54. Sp. gr. 3.09. Monoclinic, efflorescent white crystals. Loses water of crystallization when heated. Solubility, 114 at 0°C. and 87 at 50°C. Soluble in alcohol. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Tins; Kegs (10, 25, 50, 100 lb.); Drums (100 lb.); Barrels (250 lb.).

Cadmium Sulfate, Anhydrous: $CdSO_4$. Mol. wt. 208.47. Sp. gr. 4.69. M. P. 1,000°C. Fine, rhombic, white crystals. Solubility, 75 at 0°C. and 61 at 100°C. Insoluble in alcohol. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.).

Cadmium Sulfide: CdS. Mol. wt. 144.47. Sp. gr. 4.8. Fine, hexagonal orange-yellow crystals or light yellow powder. Also known as Orient Yellow, Cadmium Yellow or Cadmium Orange. Insoluble in water and cyanide solutions. Soluble in acids. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Tins (1, 5, 50 lb.); Kegs (10, 25, 100 lb.); Cases (100, 200 lb.).

Cadmium Yellow: See Cadmium Sulfide.

Calcic Liver of Sulfur: See Calcium Sulfide.

Calcined Baryta: See Barium Oxide.

Calcium: Ca. At. wt. 40.08. Sp. gr. 1.54 M. P. 810°C. Silvery white metal. Decomposes in water with liberation of hydrogen gas. Soluble in acids. Slightly soluble in alcohol. Grades: Technical-electrolytic, C. P.-lumps, turnings. Containers: Bottles; Tins (1, 5 lb.).

Calcium Acetate: $Ca(CH_3COO)_2 \cdot H_2O$. Mol. wt. 176.18. Colorless needles, white powder or granules. Also known as Acetate of Lime. Decomposes when heated. Solubility, 37.4 at 0° C. and 29.7 at 100° C. Slightly soluble in alcohol. Grades: Technical, Purified, C. P. Containers: Cartons (1 lb.); Bottles (1, 5 lb.); Cans (5 lb.); Drums (100 lb.); Bags; Barrels (200 lb.).

Calcium Carbide: CaC_2. Mol. wt. 64.10. Sp. gr. 2.22. M. P. 2300°C. Rhombic gray or grayish black crystalline granules or lumps. Also known as Carbide. Decomposes in water to form acetylene. Grades: Technical. Containers: Cans (1, 5, 10 lb.); Kegs (100 lb.); Drums (220 lb.).

Calcium Carbonate: $CaCO_3$. Mol. wt. 100.09. Sp. gr. 2.7-3.0. White amorphous powder. Also known as Precipitated Chalk. Decomposes when heated. Insoluble in water. Soluble in acids and ammonium chloride solutions. Grades: Technical, U. S. P., C. P., Precipitated—light, heavy. Containers: Bottles (1, 5 lb.); Cartons (1, 5, 10, 50 lb.); Kegs (25, 50, 100 lb.); Barrels (100, 175, 200, 250 lb.); Bags (150 lb.); Bulk.

Calcium Chloride: $CaCl_2 \cdot 2H_2O$. Mol. wt. 147.03. Colorless crystals. Solubility, 98 at 0°C. and 326 at 60°C. Soluble in alcohol. Grades: Technical, U. S. P., C. P. Containers: Bottles; Cans (1, 5 lb.); Kegs (25 lb); Tins (50 lb.); Drums (400 lb.). Also in water solution in tank cars.

Calcium Chloride, Anhydrous: $CaCl_2$. Mol. wt. 110.99. Sp. gr. 2.15. M. P. 772°C. Deliquescent white flakes, lumps or granules. Solubility, 59 at 0° C. and 160 at 100° C. Soluble in alcohol. Grades: Technical—solid, powder, fused, flake, solution; U. S. P., C. P.—lump, granular, fused sticks, fused white lumps. Containers: Bottles, Cans (1, 5 lb.); Drums (powder) (100, 400 lb.); Drums (solid) (650 lb.); Bags (flake) (100 lb.); Drums (flake) (100, 375, 400 lb.).

Calcium Chlorohypochlorite: See Calcium Hypochlorite.

Calcium Cyanide: $Ca(CN)_2$. Mol. wt. 92.12. White powder, dust or granules. Soluble in cold water. Decomposes in hot water. Grades: Technical. Containers: Bottles (1,5 lb.); Tins (25 lb.).

Calcium Fluoride: CaF_2. Mol. wt. 78.08. Sp. gr. 3.18. M. P. 1360° C. White powder, lumps, gravel or colorless crystals. Also known as Fluorspar. Insoluble in water. Slightly soluble in acids. Soluble in concentrated sulfuric acid and solutions of ammonium salts. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Cartons (1, 5, 10, 50 lb.); Kegs (100 lb.); Bags (200 lb.); Barrels (320, 400, 600 lb.); Bulk.

Calcium Hydrate: See Calcium Hydroxide.

(Continued next month)

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Fundamentals of Science Relating to Electroplating

Chapter XV. Overvoltage

IN A previous installment, the subject of voltages in electrolytic baths was discussed and it was pointed out that, with few exceptions, the moment after any appreciable current is passed through a bath, phenomena occur at each electrode which increase the voltage originally required to cause the particular reaction normally associated with the electrodes to occur. This general phenomenon was called POLARIZATION and causes were to be found in the solution near the electrodes and at the surface of the electrodes themselves. The latter was considered important enough to be given the distinction of special treatment in an earlier chapter entitled OVERVOLTAGE.

To the electroplater, the overvoltage for the release of hydrogen at a cathode is most important, and this will be evident from the following discussion which will also serve to give a more practical significance and interpretation to something which, at first glance, might seem to the casual reader to be just a theoretical item to be acknowledged once and then forgotten.

First of all, overvoltage increases as the current density increases. In Fig. 16, the curve marked H represents the voltage for the deposition of hydrogen as it varies with current density for a given solution, assuming that other forms of polarization at the cathode are negligible. This curve may be considered to be the sum of two other curves. One, marked H_e, represents the equilibrium potential for the deposition of hydrogen, i.e., this is the voltage which would liberate hydrogen if no hydrogen overvoltage or other form of polarization existed. Its particular value depends on the hydrogen ion concentration of the solution or, in other words, on the pH of the solution. Approximately, its absolute value equals .06 times the pH. The second curve used to make up the total curve H is marked H_o and is the curve for hydrogen overvoltage.

In Fig. 17, curve H of Fig. 16 is repeated and with it is a curve M, obtained in exactly the same way but representing the voltage for the deposition of a certain metal M, and equal to the sum of the equilibrium potential for this metal plus the metal overvoltage curve.

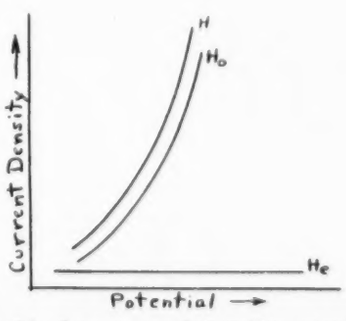


Fig. 16—Components of deposition potential.

Examining these two curves it is evident that at any current density, such as "C_1", or "C_2", the corresponding voltage from curve H, which at maximum is approximately "V_2", is less than the lowest deposition voltage for the metal, which is "V_3". Therefore, no matter what current density is used in this case, the deposition voltage for the metal M will never be reached and so only hydrogen will be evolved. Such a situation arises in the case of the metals at the top of the electromotive series, such as sodium and magnesium. If the relative positions of the two curves of Fig. 17 were reversed, then only metal would be deposited and no hydrogen. This would be true for the noble metals at the other end of the electromotive series and is practically represented by copper plated from an acid copper bath.

Suppose now that a plating solution is used in which the position of the curves is as shown in Fig. 18.

At current densities under C_1, the voltage as read from curve M will be less than V_1 so that only metal will be deposited. However, as the current density is increased above C_1, the voltage will increase above V_1 and thus exceed the minimum potential needed to deposit hydrogen. Hydrogen will begin to be evolved and the higher the current density, the greater will be the percentage of hydrogen and correspondingly the lower will be the metal plating efficiency. Actually, this efficiency will be equal to

$$100 \frac{C_M}{C_H + C_M}$$

Note that if the metal overvoltage had risen less rapidly, as in the curve M_1, it would have been possible to go as high as a current density of C_2 before hydrogen began to plate out.

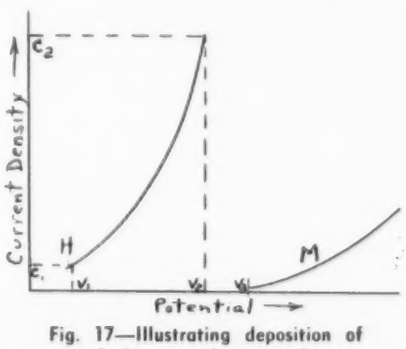


Fig. 17—Illustrating deposition of hydrogen without metal.

The situation illustrated in Fig. 18 is typical of that existing for the metals in the neighborhood of hydrogen in the electromotive series and would apply to such common plating solutions as those for nickel, iron, cadmium, and zinc. In fact, it is only because of the presence of hydrogen overvoltage that some metals can be plated in a practical manner, such as from an acid solution. This is true in the case of zinc, for example. Normally, one would expect hydrogen to be plated to the exclusion of zinc, except that the overvoltage of hydrogen is so high that actually zinc can be made to plate in preference to hydrogen.

So far we have considered only a single metal. The discussion above applies equally well to plating solutions containing two metals and if a metal is substituted for the word hydrogen above, the deposition of alloys such as brass, bronze, cadmium-silver, etc., is illustrated thereby. Other factors, however, enter the picture especially in the case of alloys, such as the solubility of one metal in the other, the particular anion present, and the effect of addition of complex-ion building radicals, but such influences will be inferred from the discussion which follows about the factors which affect the overvoltage.

There are many factors that determine the value of overvoltage. One of the most important, of course, is the composition of the electrode. Generally speaking, the more noble metals, of high melting point, like platinum and gold, show relatively small values of hydrogen overvoltage, and the lower melting metals like lead and tin show the highest values of hydrogen overvoltage. Impurities in the composition may play a significant role too. Typical values for various pure metals are given in Table XI. These values are not to be taken too

TABLE XI

A Table of Hydrogen Overvoltage

	Volts
Platinum, platinized	0 –.03
Platinum, smooth	.02–.09
Gold	.02–.24
Silver	.02–.40
Nickel	.14–.50
Copper	.17–.50
Iron	.19–.50
Aluminum	.27–.60
Cadmium	.48–.98
Tin	.53–.86
Indium	.53– ?
Lead	.36–.64
Zinc	.70–.72
Mercury	.44–.90

TABLE XII

A Table of Oxygen Overvoltage

	Volts
Gold	.52–.67
Platinum, smooth	.44–.72
Cadmium	.42– ?
Silver	.40–.58
Lead	.30– ?
Copper	.25–.42
Iron	.24– ?
Platinized platinum	.24–.40
Cobalt	.13– ?
Nickel, smooth	.12–.35
Nickel, spongy	.05–.41

literally, inasmuch as they depend greatly on the method of measuring them and the particular conditions existing at the time of measurement. The importance of cathode composition is illustrated in many practical cases. For example, note that mercury has a very high hydrogen overvoltage as compared to copper. It would therefore be much easier to cover rapidly a copper part with zinc or cadmium if the copper part were first given a mercury dip. As soon as the part were completely covered, however, it would make no difference in plating whether the mercury was there or not, because the cathode surface would then be neither mercury nor copper, but zinc or cadmium, as the case might be. The continued plating would then be easier than on the original copper but more difficult than on the mercury treated surface, because the hydrogen overvoltage for zinc or cadmium lies between copper and mercury. Another example is in the zinc plating of cast iron. The hydrogen overvoltage of the latter in the usual dull alkaline zinc solution is so low that coverage of the casting is often very difficult. Certain "tricks" must therefore be used to cover the casting, which can then be plated satisfactorily in this type of bath.

Another very important factor is the condition of the surface. The rougher surfaces have a lower hydrogen overvoltage. For example, the hydrogen overvoltage on a platinized platinum electrode (i.e., platinum covered with black spongy platinum) is practically negligible; whereas if the electrode is smooth platinum the hydrogen overvoltage may reach 0.1 volt. A practical illustration of this occurs in the case of chromium plating. It is well known that it is difficult, if not impossible sometimes, to chromium plate over old nickel deposits. The nickel has become oxidized on standing and this oxide, during cathodic treatment, becomes reduced in part to spongy nickel. The hydrogen overvoltage on such a surface is lower than that on a smooth nickel surface, increasing the facility with which hydrogen is evolved and thus also increasing the difficulty of covering such a surface with chromium.

Other factors that affect hydrogen overvoltage are: temperature, an increase in which decreases the overvoltage; time, in that even at a fixed current density it may take appreciable time to reach a steady value; superimposed alternating current, which decreases overvoltage, and electrolyte composition. The latter in turn includes addition of colloids, which increase overvoltage (which is one reason why some bright plating solutions may cover better than corresponding dull plating solutions) and pH. Increasing the pH increases the overvoltage because there are few free hydrogen ions to plate out, on the other hand changes may take place in the solution such as the precipitation of metal hydroxides. Therefore, this method of increasing hydrogen overvoltage is not without limit.

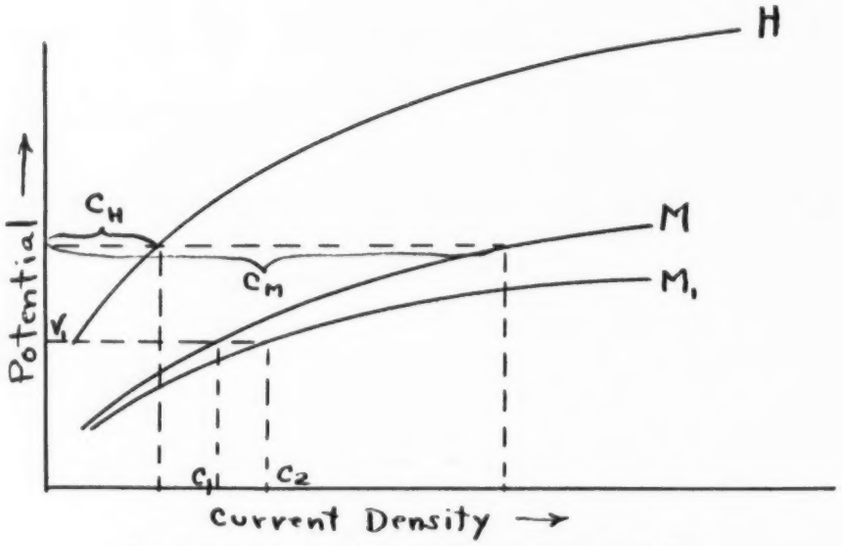


Fig. 18—Illustrating deposition of hydrogen and metal or of alloys.

Although this discussion has centered for the most part on hydrogen overvoltage, overvoltage for other elements, such as oxygen and metals, has already been mentioned. In many industrial electrochemical processes overvoltages for oxygen, chlorine, or other materials, may be the difference between success and failure of that process. Generally, for electroplaters, overvoltage other than for hydrogen and oxygen and the metals being plated is not too important. although the writer recalls a practical difficulty encountered by him in developing a stainless steel treatment, due to the liberation of chlorine from a concentrated chloride solution, that was solved only by proper consideration of the chlorine overvoltage.

Many practical applications other than those used as illustrations above might be cited and some will appear in future articles. It would be too unconventional, however, to conclude this section without stating that there are almost as many theories proposed to explain overvoltage generally as there have been investigators studying it. However, overvoltage of gases is generally associated with the formation of monatomic gas at the interface of the electrode in concentrations above those corresponding to equilibrium with the gas in molecular form.

This, the fifteenth chapter, is offered in response to many requests that the series be continued.

Because the author is engaged in vital war work, it may not be possible to present these installments at regular intervals. However, we hope to present Chapter Sixteen in the near future.

LEAD AND/OR IRON PLATERS

The following companies have responded to our inquiry as to who does lead and/or iron plating. If any others are equipped for th's kind of work, we shall be pleased to hear from them:

Bramhall, Deane Co.
51-53 East 21st Street
New York, N. Y.

Grand Plating Company
3135 West Grand Avenue
Chicago, Ill.

Henry & Logan, Inc.
36-42 Laird Avenue
Buffalo, N. Y.

Keystone Chromium Corp.
1095 Niagara Street
Buffalo, N. Y.

Industrial Chromium Corp.
Holyoke, Mass.

Stant Manufacturing Co.
Connersville, Ind.

Superior Plating & Rustproofing Co.
Minneapolis, Minn.

Thomas-Thiel, Inc.
Beech & Anchorage Streets
Wilmington, Del.

R. Wallace & Sons Co.
Wallingford, Conn.

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Recovery of Silver

Question: I would like to get some information from you about recovering silver from my silver strip. This strip is made up of cyanide of sodium and water. I strip only old Britannia ware by using reverse current. I would like to know of some easy, economical way to recover this silver and put it into my regular silver plating solution.—M. P. W.

Answer: We presume that when you speak of strip you mean the deposit which plates out on the cathodes rather than the cyanide solution itself. If so, we would suggest that you dissolve the deposit in a warm mixture of equal parts of nitric acid and water. The solution should then be diluted and the silver precipitated by adding salt. The chloride precipitate should then be washed thoroughly until all traces of the salt are removed after which the silver chloride can be used in the plating solution for replenishing.

Formula for Lead Sulfamate Bath

Question: We have become interested in lead plating and would like to try a lead sulfamate bath. However, we have not been able to find a formula for making up this bath. Will you please send us a suitable formula or tell us where to find one—G. A. I., Inc.

Answer: We are pleased to offer the following formula for a lead sulfamate bath as described by Mathers and Forney, Trans. Electrochem. Soc., 76 (1939):

Sulfamic acid	5 g.
Water	100 cc.

Add 5.4 g. lead as basic carbonate.
When dissolved, add 5 g. sulfamic acid.
Operate at room temperature at 0.215 amp./sq. dc.

Various addition agents may be used for smooth deposits such as B-naphthol, resorcinol, glue, cresylic acid, furfural, goulac, aloin, pyrogallol, etc.

You may also be interested in the lead sulfamate processes marketed by E. I. du Pont de Nemours & Co. If so, we suggest your communicating with them.

Barrel Zinc Plating

Question: Have you anything on barrel zinc plating of the cyanide type?—L. E. K.

Answer: In reply to your card requesting a reference on barrel zinc plating, we suggest that you see page 89 of the 1942 *Plating and Finishing Guidebook* which we assume you have inasmuch as you are a subscriber to *Metal Finishing* and this guidebook is distributed free of charge to all subscribers.

Literature on Zinc Plating

Question: We anticipate the installation of bright cyanide zinc in our electroplating department and would greatly appreciate any literature you have or your suggestion of a publication that would be of assistance to our plating department.—D. A. C., Inc.

Answer: In answer to your letter we are glad to recommend the three following references. Each has a chapter on zinc plating which should be interesting to your plating department. 1) 1942 *Plating and Finishing Guidebook.* 2) *Modern Electroplating.* Published by The Electrochemical Society, (1942), $5.50. 3) *Principles of Electroplating and Electroforming.* By William Blum and George B. Hogaboom. Published by McGraw Hill Book Co., Inc. (1930), $4.50.

Removal of Terneplate

Question: We have some terneplate from which we have produced a number of stampings. We should like to remove the lead coating from these stampings and would appreciate having you advise us how to do this.—O. M. Co., Ltd.

Answer: Terneplate may be removed by immersion in glacial acetic acid containing five per cent by volume of 30 per cent hydrogen peroxide. You can test for complete removal of the terneplate by drying a sample and drawing the end of a piece of stiff copper wrire across its surface. This will leave a copper-colored streak on iron but not on lead.

Another method for removing this alloy is to heat in concentrated sulfuric acid at a temperature of at least 260°C., the pieces being in contact with a piece of nickel wire. This is a rapid method but a small amount of iron will be dissolved.

Bright Dip for "Nickel Silver"

Question: You will find enclosed several "nickel silver" springs containing 16% nickel, 68% copper and the balance, zinc. It is necessary that these have a mirror bright finish and inasmuch as they are being dipped in very large quantities, a dependable dip is essential. At present we are using a 50-50 mix of nitric and sulfuric acids which is fairly satisfactory. We thought, however, that you might offer a more reliable mix to bring out the bright finish. Thank you in advance for any consideration you may give us.—U. R. P. Co.

Answer: The dip you are using is satisfactory. However, you may try the following:

Sulfuric acid	2 gal.
Nitric acid	1 "
Water	1 qt.
Hydrochloric acid	½ oz.

If the above formula gives as good a finish as the one you are using, it will be cheaper to operate.

Silver Finish on Copper

Question: To obtain a silver finish on copper we have used a powder in moistened state composed of:

Silver chloride	1 part
Potassium tartrate	4 parts
Sodium chloride	3 "

Can you inform us if this is the best composition for the purpose or suggest an improved method?—G. S. R.

Answer: We suggest that you dip the copper in a solution of 1 oz./gal. silver cyanide and 1 oz/gal. sodium cyanide. This dip is easier to use than the powder since it applies the silver by immersion without rubbing or individual handling of parts.

Sources of Thiourea

Question: In the article entitled "Bright Copper Plating in Acid Baths," printed in *Metal Finishing* in September, 1942, you give the formula for a typical bath containing an ingredient named "thiourea". I want to know the address of the company who manufactures this material so I can experiment with same in my work.—W. S.

Answer: Thiourea may be purchased from the following manufacturers: American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York, N. Y.; Merck & Co., Inc., Rahway, N. J.; Monsanto Chemical Co., St. Louis, Mo. Local laboratory supply houses may be able to supply you with this material in small quantities.

pH of Nickel Solutions

Question: A question has come up concerning the pH of nickel plating solutions. When the pH value is given as "pH, colorimetric—5.4-6.0", does this mean that the colorimetric value should be 5.4-6.0 or that the colorimetric value should be 5.9-6.5 to allow for the 0.5 pH error? This question arose from two interpretations of the paragraphs on pages 114 and 116 in the 1942 edition of the *Plating and Finishing Guidebook*, where the "salt effect" is discussed.—C. T. S. Co.

Answer: When the colorimetric pH values are given, they are the values as determined by this means. In other words, a colorimetric pH of 6.0 will mean that the sample with indicator in it will match the 6.0 color standard.

In nickel plating solutions, the pH using color standards and indicators is generally about 0.5 higher than the electrometric pH which is standard. In other words, if a given nickel solution were tested by the colorimetric and electrometric methods, you would find that in the former case the pH would be 6.0 and in the latter case, the determination would show pH as 5.5.

Early Use of H_2SO_4 as Anodic Pickle

Question: Can you or your readers furnish the writer with information as to the use of sulfuric acid as an anodic pickle for metal cleaning. In particular, how far back can its use be traced and by whom?—C. S. Co.

Answer: The earliest reference we have been able to find is on page 220 of the seventh edition of Langbein's "Electrodeposition of Metals" (1912) in which mention is made of the use of sulfuric or hydrochloric acid with reverse current. The use of reverse current in sulfuric acid for improving plating adherence rather than for the removal of scale was the subject of a patent granted to C. P. Madsen, U. S. Pat. 1,562,710 on November 24, 1925.

Iron Plating Solutions

Question: We would appreciate your advising us of a formula for an iron solution that is simply and easily operated.—S. P. W.

Answer: There are two iron plating solutions in use today—the chloride solution and the sulfate solution, both of which are described in detail in the 1942 edition of the *Plating and Finishing Guidebook* on pages 62-64.

The chloride solution is used for heavy deposits of soft and ductile iron. Due to the high operating temperature and corrosiveness of this solution, however, the equipment required may be different from that ordinarily used in a plating shop.

The sulfate solution can be operated in a lead-lined tank without any particular precautions. The deposits obtained are very hard and this solution can not be used safely for thicknesses above approximately 0.001" although heavier deposits have been produced.

Solution for Hard Nickel Plating

Question: The hard nickel solution we are using consists of the following:

Single nickel salts	24 oz./gal.
Ammonia chloride	3 1/3 " "
Boric acid	4 " "
pH	6.0
Temperature	140°F.
Current density	Up to 50 amp./sq. ft.

To date we have not been successful with this plate and would appreciate it if you are not in a position to supply us with suggestions yourselves, you will refer us to someone who is familiar with this work.—C. R. P. Ltd.

Answer: The formula you mention in your letter is that of Wesley and Roehl as given in their paper presented before The Electrochemical Society last year.

You mention that a pH of 6.0 is used with a temperature of 140°F. and current densities up to 50 amp./sq. ft. You state that you have not been successful with this plate but you do not state in what way your deposit was unsatisfactory. If it was not sufficiently hard, we suggest you use a temperature of 120°F. and a higher pH such as 6.5 colorimetric and, if possible, a higher current density, up to 100 amp./sq. ft. All these will contribute to the production of a harder deposit.

If changing the operating conditions does not solve your problem, you might communicate with Dr. W. A. Wesley at the Research Laboratories, International Nickel Company, Bayonne, N. J.

Solution for Plating Copper Tip Soldering Equipment

Question: I would appreciate data on the type of solution necessary for plating copper tip soldering equipment.—D. D.

Answer: Soldering tips are plated with 0.002-0.003" iron using the chloride solution. Details on this solution will be found in the 1942 edition of the *Plating and Finishing Guidebook*, page 62.

Special racking and suspending devices are required to obtain the proper type of deposit. The articles must be agitated.

Information on Lead Plating

Question: Can you tell me anything more about lead plating than that which appears in the *Plating and Finishing Guidebook* or can you direct me to where I can obtain such information?—L. K.

Answer: A chapter on this subject is to be found in *Modern Electroplating*, published by The Electrochemical Society in 1942. This book may be ordered through *Metal Finishing* at a cost of $5.50.

Information on various proprietary lead plating processes may be obtained from companies advertising same in *Metal Finishing*.

Most lead plating is done in fluoborate solutions with various addition agents. However, lead sulfamate baths may be available if you can produce a sufficiently high priority rating.

Iron Steam Coil in Silver Solution

Question: Kindly advise us if there is any objection to using an iron steam coil in our silver solution to raise the temperature these cold days. We can use insulators on this so there will be no escape of current. It is claimed by some that the silver will collect in large quantities on the iron pipe.—S. P. W.

Answer: An iron steam coil is very satisfactory for this purpose but it is essential that suitable insulators be used at each end of the coil to avoid any stray current effects. If the coil is insulated at both ends there will be no deposition of silver on the iron pipe. However, to avoid stray current effects, you can connect the iron pipe to the anode rod by a piece of light wire. This will make the coil anodic at all times. There will be no loss in silver even with the coil anodic because of the fact that the current will enter the solution through the silver anodes by preference.

It is excellent practice to raise the temperature of silver plating solutions not only on cold days, but also on warmer ones maintaining the solution at 85°F., if possible, so that maximum speed of deposition may be obtained.

Metallography References

Question: As we are doing some research work on electrodeposited coatings of different metals, plated as layers adjacent to one another on a base metal, we thought that perhaps you could give us some information on the metallographic examination of these layers which diffuse into one another to form alloys during subsequent heat treatment.

We are plating layers of copper and zinc, copper and tin, nickel and chromium and various other combinations. The base with these coating layers is then heat treated at 1100°/2500°F. causing diffusion of these metals one into the other and/or into the base to form alloys. As we wish to determine the depth of alloy formation, the problem arises as to the proper method of polishing and etching these layers which may range from 0.0001 — 0.010" in thickness and being able to distinguish the alloy layers from those of the pure metals so that depth of penetration may be noted.—S. S. Corp.

Answer: We are pleased to offer the following references on the metallographic examination of electrodeposited coatings of different metals which diffuse into one another forming alloys during subsequent heat treatment: 1) The Bausch & Lomb Catalogue. 2) Cymboliste, Trans. Electrochem. Soc., *73* (1938). 3) *The Metals Handbook*, Published by the American Society for Metals, 7301 Euclid Ave., Cleveland, O. 4) A. S. T. M. Designation A219-50T. 5) *Principles of Metallographic Practice*, By G. S. Kehl, Published by McGraw Hill Book Co., Inc. (1943), $4.00.

Patents

Cleaning and Pickling Iron and Steel

U. S. Pat. 2,311,099. U. C. Tainton, Feb. 16, 1943. In a process for treating a solid metal article to remove oxide, scale and the like, the steps of providing a bath of a molten compound of a metal from the group consisting of the alkali and alkali earth metals containing in solution a metal also from said group and electropositive relative to the treated metal of the article, introducing said article in solid form into said bath without connection of said article as an electrode of an electric source supplying current to the bath, said article being solid at the temperature of the bath, maintaining said bath at a temperature below the boiling point of said treating metal and sufficiently high above the fusion point of the molten compound to maintain said supplied metal in solution in said bath at the areas of contact with said article whereby to avoid a deposit of said treating metal on said article, continuing said treatment for a sufficient length of time with sufficient treating metal in solution and without connection of the article as an electrode of an electric source, to complete the desired reduction of the oxides, scale and the like in the bath without dependence on current through the article as an electrode of an electric source and without accumulation of deposit of said treating metal on the article, and removing the article from the molten bath.

The article may be treated subsequently with an aqueous acid bath.

Cleaning and Pickling Ferrous Alloys

U. S. Pat. 2,311,139. U. C. Tainton, Feb. 16, 1943. The process of treating a metallic article comprising the steps of placing said article in circuit and subjecting it to electrolysis as an anode in a molten bath of a compound of a metal of the group consisting of the alkali and alkali earth metals adapted to preliminarily treat the surface with an oxidizing action preparatory to subsequent de-oxidation, continuing said anodic treatment for a time sufficient to oxidize any grease, carbon or the like adhering to the said metallic article, then subjecting said article in electrical circuit to electrolysis as a solid cathode in a bath of molten compound of a metal of the group consisting of the alkali and alkali earth metals adapted to be liberated at the surface of the cathode in said electrolysis, and subjecting the article to the action of said molten bath of the compound at a temperature below the boiling point of the liberated metal and sufficient in excess of the fusion point of the molten compound to dissolve the liberated metal in said bath and avoid a deposit of said metal on said article, maintaining said treatment for a sufficient time to completely reduce oxides, scale and the like while the article is in the bath and then delivering said treated article from said molten bath free of any sensible deposit of said dissolved metal.

Corrosion Prevention of Iron and Zinc

U. S. Pat. 2,310,239. G. W. Jarnstedt, assignor to Westinghouse Electric & Mfg. Co., Feb. 9, 1943. The process of treating ferrous and zinc metal surface to provide corrosion resisting coatings thereon which comprises, in combination, applying an aqueous solution having from 0.1% to 2.0% disodium phosphate and 0.005% to 0.05% titanium, the titanium being present as a compound, to activate the metal surface and applying a solution of phosphoric acid, phosphates, and an oxidizing agent to the activated metal surface to produce a protective phosphate coating thereon.

Example: Activating Solution:

Disodium phosphate plus from 0.005% up to 20% by weight of titanium as an ionizable salt are dissolved and the mixture evaporated to dryness at temperatures above 60°C. The dried composition is dissolved in water to produce a solution having from 0.1 to 2% disodium phosphate and 0.005% titanium ions in solution. The pH of a 1% solution of disodium phosphate with 0.01% titanium radical will be from 8.0 to 8.5 and this appears to be the optimum concentration. The solution is applied by spraying or dipping for 10—45 seconds and the article is transferred to a phosphate solution.

Example: Phosphate Solution for Zinc:

Iron	0.03-0.30%
Zinc phosphate	0.04%
Sodium nitrate	0.2 -1 %
Phosphoric acid to produce a 20 point solution and comprising 1:8 of total phosphate content	
Water	Remainder

Time: 30 seconds or less.

Example: Phosphate Solution for Iron:

Manganese phosphate	1.75 lb.
83% Phosphoric acid	5 lb.
Sodium nitrate	0.5 lb.
Cupric nitrate	0.25 oz.
Water	To make one gallon

This is diluted with water to make a 3% solution. The phosphate film is sealed with a chromic acid dip.

Hot Dipping Process

U. S. Pat. 2,310,451. W. E. Marshall, assignor to The American Rolling Mill Co., Feb. 9, 1943. A process of preparing iron and steel for coating with molten metal, which comprises cleaning the iron or steel and coating it with a phosphorus bearing material chosen from the class consisting of a water solution of phosphoric acid and water solution, having an acid reaction, of a salt of phosphoric acid, drying the iron or steel so as to leave a coating of phosphorus bearing material on its surfaces, and thereafter heating it in the presence of a reducing atmosphere, at sufficient temperature and for a sufficient length of time to reduce the phosphorus bearing material and to cause it to be absorbed by the surfaces of the iron or steel.

Example:

Phosphoric acid 20-30% by weight
Heat at 500-700°F.

Coloring Magnesium Oxide Coatings

U. S. Pat. 2,310,487. H. K. DeLong, assignor to The Dow Chemical Co., Feb. 9, 1943. In a method of coloring hydrated oxide protective coatings upon surfaces of articles of magnesium and magnesium-base alloys, the steps which comprise immersing the coated article in an aqueous solution of a water-soluble dye and a water soluble salt of an unsubstituted organic carboxylic acid.

Example:

Chromium containing mordant azo dye	0.2-10 g./L.
Water soluble acetate	0.1-10 g./L.

Temp.: 50-100°C.

Example:

Immerse for 10 minutes in a boiling solution of:

Ammonium acetate	0.2%
Neolan Bordeaux R	1.0%

Graphiting Electrotype Molds

U. S. Pat. 2,313,622. G. W. Bungay, Mar. 9, 1943. A machine for applying a coating of black lead or the like to a sheet material, comprising conveyor means to feed said material past a treating station, brush means at said station positioned to engage the surface of said material, said brush means comprising a brush extending across said conveyor means with bristles extending downwardly to contact said surface, a pair of rods carrying opposite ends of said brush and extending downwardly on opposite sides of said conveyor means, and eccentric means actuating said rods to cause said brush to reciprocate vertically for tamping said black lead into said surface as the sheet material is fed along by said conveyer means.

Strip Electroplating Process

U. S. Pat. 2,312,452. E. S. Taylerson, assignor to Carnegie-Illinois Steel Corp., Mar. 2, 1943. In the continuous electroplating of metallic strip, the method which includes supporting a series of aligned flat-faced soluble anodes with their flat faces in adjacent parallelism with a side of the strip, progressively moving said series of anodes across and in a path inclined toward the strip, the progressive movement and inclined path aforesaid coacting to maintain substantially uniform spacing between the strip and the series of anodes as the erosion of the latter progresses, successively removing worn anodes at one end of said series, and introducing fresh anodes at the other end of said series.

Also in apparatus for continuously electroplating metallic strip, a series of anodes supported transversely of the strip and substantially uniformly spaced from a side of the latter, said anodes progressively varying in cross section from a maximum adjacent one edge of the strip to a minimum adjacent the other edge thereof, and means for moving said anodes in the direction of their decreasing cross section transversely of and toward the strip to compensate for erosion of the anodes whereby the substantially uniform spacing aforesaid is maintained.

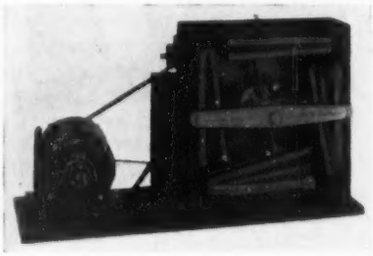
NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

New Vacuum Pump

A positive-type vacuum pump for production and laboratory applications has been announced by American Automatic Typewriter Co., 614 N. Carpenter St., Chicago, Ill. Available in two standard sizes, the pump is supplied with individual electric-motor drives, or without motors for use with an available power source.

The pump employs four bellows mounted within a square wood frame, connected to each other and to the pump outlet by a channel running through the frame. Bellows, which are successively expanded to exhaust air or gas from the equipment to which the pump is connected, are driven by a revolving shaft through connecting straps. The shaft is V-belt driven at a relatively slow speed, approximately 200 RPM, contributing to a smooth quiet running unit and low maintenance.



New-type vacuum pump.

The flexible sides of the bellows are made of leather, as are the intake and exhaust valves. All joints are gasketed by a sheet of neoprene cloth, and the frame or case has a black wrinkle finish.

The larger of the two units is rated at 15 cu. ft. displacement at four inches of mercury. The bellows are six inches wide, and individually driven pumps use a ½-horsepower motor. The smaller unit, rated at 7 cu. ft. displacement at four inches of mercury, has 4-inch bellows and uses a 1/6-horsepower motor. The pumps are equipped with governors to vary their capacities, and to prevent excessive wear on pump parts, the power transmission unit or the motor when air or gas has been exhausted to the capacity of the pump.

Glass and Porcelain Cleaner

Ordinary washing usually will not remove rust, shop dirt and stains from factory windows. And the necessity of the dangerous and costly acid bath is alleged obviated by the use of "Bull Frog" Saf-T-Klenz, a new product of the Berman Chemical Co., 365 Tenth St., Toledo, O.

This material is claimed to speedily remove iron rust, lime deposit, soap oils, body grease and discolorations from shower room floors and walls, wash bowls, fountains, etc. It is said to have an immediate deodorizing action.

Saf-T-Klenz comes in dry powder form, is unconditionally guaranteed and contains nothing harmful to the skin, according to the manufacturers who offer a generous free trial sample on request.

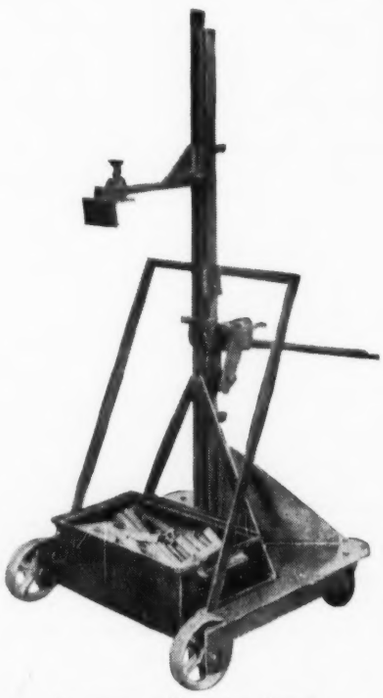
Stacking Box Carrier

A new stacking box carrier has been announced by the Ernst Carrier Sales Co., 1456 Jefferson Ave., Buffalo, N. Y.

This heavy-duty carrier is designed especially to handle a column of self-nesting boxes of finished parts, scrap, castings and similar materials. A built-in wedge at the bottom of the lift post slides under the stack eliminating the use of a skid.

After sliding the wedge under the stack, leaning on the handle will cause the stack of boxes to be raised from the floor. When the handle reaches the horizontal position, it automatically locks into position. The load is three inches off the floor and can be moved without tipping. Forward tipping or swaying is eliminated by an adjustable clamp that lowers over the back edge of the top box. Side sway is eliminated by a reinforcing bar mounted diagonally from the top of the post to the base.

This new stacking box carrier is equipped with four large diameter wheels and the square base inside measures 33 inches in width. Rated capacity of the carrier is 1500 pounds.



To carry self-nesting boxes.

Professional Directory

CONSULT US ON
GOVERNMENT & INDUSTRIAL SPECIFICATION PLATING
A. ROBINSON & SON
131 Canal St., New York
Telephone CAnal 6 } 0310 } 0464
64 Years in Precious Metals

Platers Technical Service Co.
Electroplating and Chemical Engineers
Complete services, including solution analyses, process development and deposit tests.
S. C. Taormina .....Tech. Director
Dr. C. B. F. Young .....Tech Advisor
Dr. G. Amorosi .....Engr. Advisor
(Professional Engineer)
59 E. 4th St., N. Y. C. ORchard 4-1778

G. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
SALT SPRAY TESTING—CERTIFIED TO MEET ARMY AND NAVY SPECIFICATIONS. Testing of deposits-thickness, composition, porosity. Solution analyses, plant design, process development.
44 East Kinney St. Newark, N. J.

JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant
War plating plants designed and streamlined for increased production.
LA 4-9794 233 W. 26th St.
New York City

BUCKINGHAM COMPOUNDS

NOW USED IN

WAR PRODUCTION

BURRING • GREASELESS

HARDENED STEEL COMPOSITION

Samples Shipped Promptly

THE BUCKINGHAM PRODUCTS CO.

8900 HUBBELL AVE. DETROIT, MICH.

A MODERN AID TO PRODUCTION!

M·S·A

FEND

BARRIER PROTECTION *for the worker's skin*
AGAINST INDUSTRIAL DERMATITIS

. . . Important news to every plant superintendent, safety engineer and company executive concerned with checking the urgent problem of industrial dermatitis, and keeping men on the job without loss of time and production!

Distributed exclusively by the world's largest manufacturer of approved safety equipment, produced by intensive new research for *better skin protection, M.S.A.* FEND Creams and Lotions provide complete barrier protection against many-score specific skin hazards in industry . . . medically and cosmetically correct, non-toxic, safe and economical to use, uniformly effective *on the job!*

FEND Creams are easy to apply, bland and neutral. Each FEND product contains its own skin-conditioning factor. FEND Creams or Lotions are non-sticky, non-clogging, do not interfere with normal action of skin and skin glands, and are in many ways the long-sought preventives of skin dermatoses in industry.

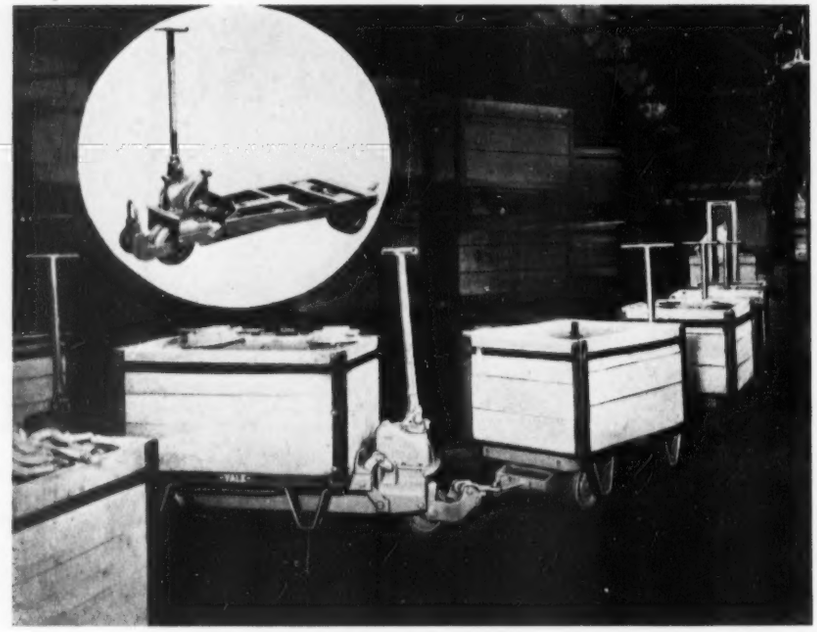
Write for Complete FEND Facts!

Detailed in this 16-page FEND Bulletin is the whole story of Barrier Skin Protection. Send for your copy.

MINE SAFETY APPLIANCES COMPANY

Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

District Representatives in Principal Cities



New Trailer-Type Hand Lift Truck

As a remedy for the need for more efficient methods of mass movements of materials, the Yale & Towne Manufacturing Co., Philadelphia, Pa., designed and developed the new Yale Load King Trailer Type Hand Lift Truck shown below.

Fitted with Safety Self-Coupler attachments front and rear, the unit is ideal for trailer train operations—a method by which materials can be quickly dispatched over greater plant areas in short time.

When not operating as a trailer, the Load King functions as a conventional-type hand lift truck. It embodies in its construction all the regular hand lift truck features.

The Self-Coupler attachments with which these trucks are equipped simplify the method of connecting or disconnecting train formations. The operator merely pushes trucks together and the front end coupler loop slides through the jaw ends of the other truck coupler, pushing up the latch which automatically drops into locked position, forming the train. To break train, the operator steps on the pedal pad of the latch casting, disconnecting the trailers.

Photoelectric Glossmeter

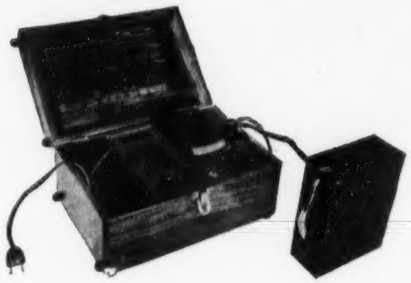
The smoothness of finish of metal surfaces can be registered with the new Photoelectric Glossmeter of Photovolt Corp., 95 Madison Ave., New York, N. Y.

The instrument is suited for machined or polished surfaces as well as for electroplated and coated surfaces. It indicates the specular gloss of such surfaces in terms of a perfect front surface mirror as 1,000.

The instrument consists of two units. The search unit is placed on the sample to be tested and the instrument proper comprises the controls and the indicating instrument. The two units are connected by cable and plug connection. Search units can be furnished for 45 degree, 60 degree, and 75 degree gloss.

The Glossmeter is available in two models, the one being operated from dry-cell batteries which are housed in the instrument casing, the other being designed for operation from the power line or from a storage battery.

The instrument is self-contained and built into a portable housing with cover and carrying strap. It may be used in the laboratory as well as in the shop and in production control and its operation is said to be simple and convenient.



Abrasive Belt Backstand Idler

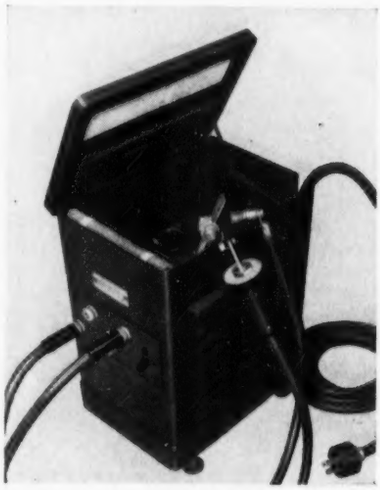
Hammond Machinery Builders, Inc., Kalamazoo, Mich., announce the new No. 3 abrasive belt backstand idler, used in conjunction with abrasive belts running over contact wheels employed on grinding and polishing equipment. Its new spring loaded adjusting screw and hand wheel (patent applied for) are said to make easy work of maintaining tension of belts or releasing tension for making changes.

Prepares Surfaces for Metallizing *Electrically*

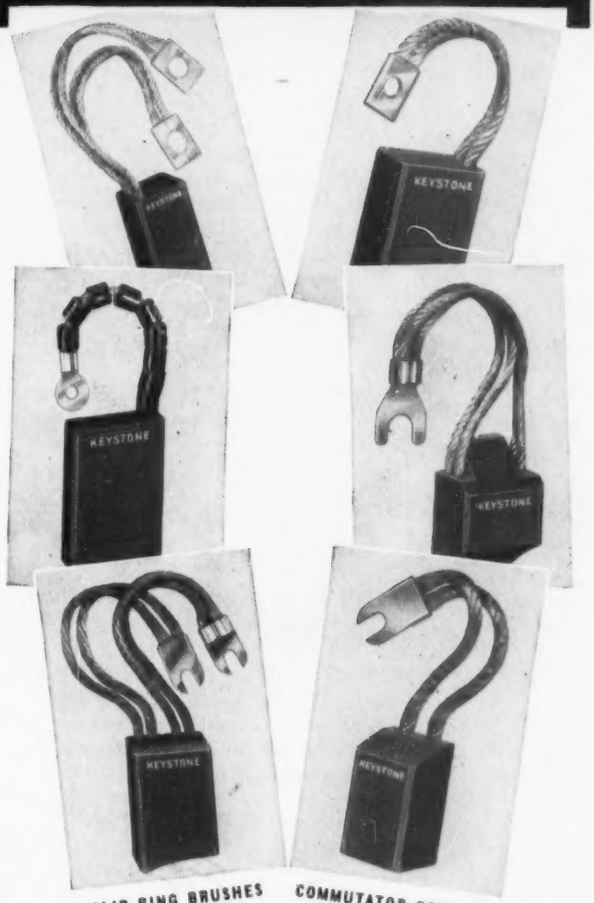
Metallizing Engineering Co. Inc. 29-28 41st Ave., Long Island City, N. Y., have announced a new process, and equipment for its application, whereby machine components and similar metal parts may be prepared for metallizing *electrically*. It is claimed that the main advantage of the process is that it affords an adequate bond on the hardest surfaces. It is also said to simplify preparation of narrow edges, flat areas, and cylindrical parts having keyways, and other interruptions in their surfaces.

Application of the process is with the Metco Fuse-Bond Unit. Operating on any 110 or 220 volt, single phase power line, this equipment fuses a rough deposit of electrode metal into the surface to be metallized. Electrodes are applied to the work with a special holder which uses up to six electrodes at a time, depending on the size and nature of the part to be prepared. Small parts may be prepared with this equipment as easily as large shafts, since there is no excessive heating of the base metal, or disturbing of its physical characteristics.

The Fuse-Bond Unit is contained in a cabinet measuring 24" high. Its weight is 170 lbs. All cables and attachments fit into a bin in the top of the cabinet. It is mounted on casters.



FOR LOW VOLTAGE GENERATOR and SLIP RING APPLICATIONS
Use
KEYSTONE
Metal-Graphite Brushes



SLIP RING BRUSHES COMMUTATOR BRUSHES

Excessive energy losses caused by high contact drop or abnormal brush sparking can rob you of uniform, dependable electrical energy. Maximum performance may be secured by using Keystone Metal-Graphite Brushes which offer low contact drop, low friction, and efficient operation.

Keystone Metal-Graphite Brushes have a high current-carrying capacity and excellent lubricating qualities. The shunts, which are moulded directly into the brush, establish a perfect connection.

We carry in stock Metal-Graphite Brushes for standard types of equipment. Let us serve you.

KEYSTONE CARBON CO., INC.
Manufacturers of Precision Moulded Products
1935 STATE ST.. SAINT MARYS. PENNA.

Now that Platinum and Rhodium are out for the duration, investigate

PALLITE
TRADE MARK

The New and Perfected

PALLADIUM PLATING BATH*

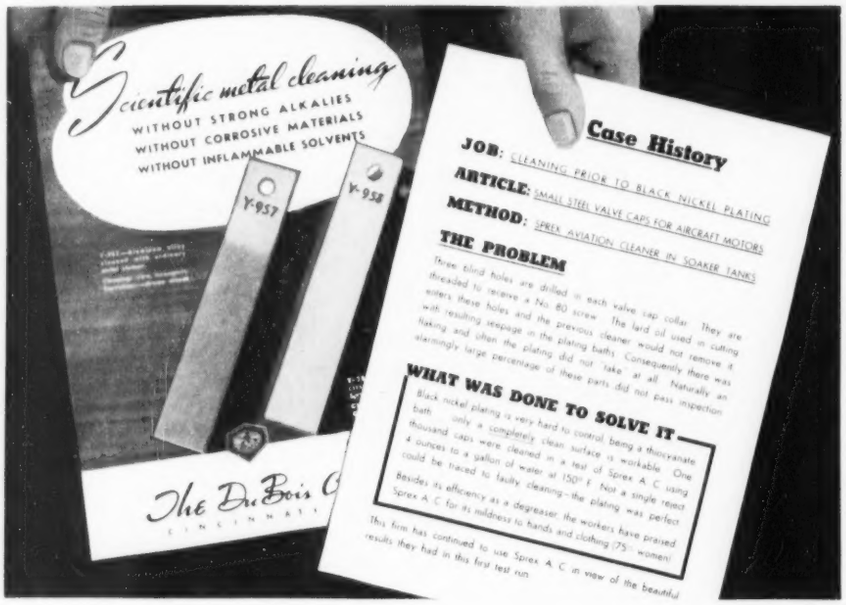
PLATE with
PALLITE
PALLADIUM PLATING SOLUTION
to get the brilliant Non-Tarnishing Plate.

To be applied on low carbon steel, an undercoating of silver (half-thousandths thick), must be applied before plating with PALLITE. This will be necessary to make steel rust-proof.

* Pat. Pending

PRECIMET LABORATORIES
Division of GEORGE C. LAMBROS - Refiners and Smelters
RESEARCH AND DEVELOPMENT ENGINEERS IN PRECIOUS METALS
64 FULTON STREET NEW YORK

HELP for the man in charge of METAL CLEANING



Whether you are removing cutting oil, grease, drawing compound, emery dust, smut, or other soil . . from **aluminum, magnesium, steel, brass, copper, nickel or other metals and alloys** . . by washing machine or in immersion tanks . . . . these pamphlets will show you how prominent War Plants are getting maximum efficiency in a metal cleaning operation **similar to yours.**

The "Case History" shown above is one of a series illustrating how DuBois Products eliminate metal cleaning bottlenecks. Give us a description of your present metal cleaning procedure and we will send you a select group of "Case Histories" that show how we have helped to improve operations **similar to yours.** Write for this helpful free literature today!

★ **THE DU BOIS COMPANY** ★

1120 WEST FRONT STREET • CINCINNATI, O.

TRAINED SERVICE TECHNICIANS AND WAREHOUSE STOCKS IN CITIES FROM COAST TO COAST

Chemically Clean Surfaces Secured Quickly with PERMAG Compounds

Speed in cleaning metal is very essential these days. Work can't wait. War demands call for swift, efficient action.

That's why PERMAG Compounds are so often selected to do most important cleaning jobs in both large and small industries throughout the country. PERMAG is a tested compound—on the market over 20 years.

If production requirements have brought new metal cleaning problems, let the Magnuson Cooperative Service help you. That's our field.

Write us—no obligation for interviews—or telephone.

MAGNUSON PRODUCTS CORPORATION

Mfrs. Specialized Scientific Cleaning Compounds for Industrial Purposes

MAIN OFFICE: 50 COURT ST. BROOKLYN, N. Y.

In Canada: Canadian Permag Products Ltd., Montreal and Toronto

New Finishes

The Mitchell-Bradford Chemical Co., 2446 Main Street, Stratford P. O., Bridgeport, Conn., are the manufacturers of two new products—"Magic-Etch"—a dull finish and "Silco"—a new type of finish founded on an inorganic base.

"Magic-Etch" is a chemical process used in conjunction with the firm's "Black Magic" process to produce a dull matte which reflects no light. It is said to be a harmless, chemically balanced solution which, when agitated with compressed air, produces a uniform dull matte surface without affecting the structure or tensile strength of the steel.

"Silco"—a finish specially designed for steel, brass and chrome plate—is claimed to be impervious to many solvents, resistant to mild alkalis and acids and being inorganic, will not burn off. The material is recommended particularly for use in refinishing exhaust manifolds and pipes and mufflers for gasoline engines.

Metal Parts Washer

The Sturdy-Bilt Equipment Corp., West Allis (Milwaukee), Wis., have announced their new "Simplex" metal parts washer. An improved automatic unit, designed to replace complicated methods of cleaning, washing and preparation of small metal parts, castings, stampings, etc., it is inexpensive and compact and combines a standard method with a new simplified action that does a thorough job in less time.

The solution in the tank (as determined by the particular application) provides a chemical action during the soak—loosening grease, oil, dirt and foreign metal chips. The "swishing" action into and out of the solution provides a soaking and washing action that removes foreign material. Hot or cold solution may be used.

The tank is fully insulated and the cleaning solution is heated to a temperature of 120-130° by means of steam, electricity or gas. An electric motor operates a lever mechanism which lowers and raises the "material tray" into and out of the soaking tank. A switch pressed by the operator sets the machine in motion.

These units can also be used for preparing metals for further machining, for plating, enameling, etc. They can be installed in different departments or in a series—one unit for cleaning, another for rinsing or rust prevention coating and others for other special requirements.

New Buffing Compound

A new buffing compound to be used with a tampico wheel has been developed by Harrison & Co., Inc., Haverhill, Mass.

Called #5545-4F, it is recommended particularly for fine work such as instruments. It is applied on a tampico buff following a fine grinding operation on production parts, leaving a smooth finish.

Manufacturers' Literature

Industrial Ovens

"Industrial Ovens" is the title of a 22-page booklet on that subject issued by *The Kirk & Blum Manufacturing Co.*, Cincinnati, O.

Photographs and "blue prints" are used for illustrations. Various testimonials are given in the text.

Plastic for Tank and Pipe Lining

Paramount Rubber Co., 10401 Northlawn, Detroit, Mich., have issued a folder describing their Seamless Plastic as an alternative for rubber to line tanks and pipes. The material is described as being particularly adaptable for tanks or drums used in nitric acid passivating.

Industrial Handling Equipment

Rose Manufacturing Co., 12400 Strathmoor, Detroit, Mich., are the publishers of an 18-page, spiral-bound catalogue section on factory trucks, trailers and dump hoppers. Several industrial trucks and dump hoppers are photographed and described as are individual parts such as wheels and axle brackets. Specifications for various rigid and swivel-type casters are given.

Selenium Rectifiers

The Benwood Linze Co., 1811-19 Locust St., St. Louis, Mo., have issued a Bulletin R-40 on their selenium rectifier plates and stacks. Pertinent facts and figures covering the characteristics and applications of selenium rectifiers are given.

Wartime Conservation

"Wartime Conservation," a new 96-page booklet just published, contains recommendations by Westinghouse engineers for selecting, applying and using electrical equipment to achieve the best possible production with the greatest saving in critical materials.

The booklet covers up-rating of motors, thermal temperature loading of transformers, industrial network systems, line equipment and materials, and give tips on saving and salvaging materials as practiced in the various Westinghouse plants.

In addition to pointing out ways of saving vital materials in new equipment purchased, the booklet gives examples of how existing equipment can be made to give better service and greater out-put by up-rating or rebuilding with more efficient materials than originally used.

All recommendations in this new book are in line with policies suggested by the W.P.B. for the conservation of critical materials. A copy of booklet B-3206 may be secured from Department 7-N-20, *Westinghouse Electric and Manufacturing Co.*, East Pittsburgh, Pa.

BUNATOL
ENGINEERED INSULATION

for

ALL Electroplating Racks
ALL Anodizing Racks

•

Rack insulation need no longer be a production headache due to short life and high costs. Today, with BUNATOL, it's long life, low cost production.

This tough, splendidly adhesive insulant provides a flexibility in keeping with the flexibility of the spring clips attached to the rack itself. It, therefore, does not become brittle, crack or peel when the clips are flexed.

Because this flexibility is retained for the life of the insulation, BUNATOL retains its efficiency and provides maximum rack protection.

Easy to apply, inexpensive to use, BUNATOL assures more production, fewer "rejects" and less generator load with the same equipment.

Every claim we make for BUNATOL has been proven by America's leading production shops. Find out what it can do for you. Write today for complete information.

NELSON J. QUINN CO. • TOLEDO, OHIO

Heavy-Duty Rectifiers

P. R. Mallory & Co., Inc., Indianapolis, Ind., have issued a 24-page booklet on heavy-duty rectifiers.

The advantages and applications of their line of rectifiers are reviewed before a comprehensive chapter entitled "Fundamentals of Designing a Power Supply". In the latter chapter, sub-divisions discuss rectified wave form and circuit conclusions; Type of Load-resistive, inductive, capacitive and battery; filtering; voltage drop; transformer design; resistance control; series and parallel operation; intermittent operation; A. C. line frequency and ventilation. Special Rectifier Calculations cover inductive, capacitive and resistance load curves; three phase full wave curves, and energy computations and alternating current characteristics in single and three-phase half and full wave data.

The text of the booklet is clear and the diagrams simple.

Two pages are devoted to specifications of Mallory Heavy-Duty Rectifiers.

New Q-Floor Wiring Manual

A new, 48-page manual on floor wiring for under floor electrical distribution in H. H. Robertson cellular steel Q-Floors is announced by the Construction Materials Division of *General Electric Company's Appliance & Merchandise Department*, Bridgeport, Conn. G.E. Q-Floor wiring materials are designed so that the hollow cells of Q-Floors may be used as raceways for wiring thus making it possible to provide electric power outlets wherever needed throughout the entire floor area.

The new manual includes catalog listings of G.E. Q-Floor wiring accessories and fittings, and detailed data on layout and installation procedure. A 13-page technical data section contains illustrations and descriptions of G.E. Q-Floor wiring materials, including catalog numbers and shipping weights. Layout and installation information is illustrated with diagrams and photographs. Sample specifications are included in the layout section. Copies of the manual are available on request.

Have You a Problem Dealing with PROTECTIVE COATINGS

The protective coating materials manufactured by Michigan Chrome and Chemical Company have innumerable applications. They are used for the insulation of plating racks which go through almost all cleaning and plating cycles . . . for masking parts for hard chromium plating . . . for localized hardening of steel parts . . . for protection of baskets used in washing and pickling processes . . . for protecting and beautifying plated or natural metal surfaces . . . for resistance to rust and corrosion . . . and numerous other purposes.

Many of these applications have been developed as a direct result of the needs of certain customers. In some instances, the recommendation of our standard coating materials—used alone or in combination—have produced the desired results. In other cases, new materials best suited to the specific purpose have been developed in our laboratories.

As manufacturers of a wide variety of protective coatings . . . as experienced platers operating one of the largest plating plants in the Middle West, and where the materials receive every possible "on the job" test . . . we are well-equipped to work with you on any protective coating problem. Your inquiries will receive immediate attention.

We Can Demonstrate How These Materials Will Meet Your Needs

MICCRO-SUPREME STOP-OFF LACQUERS

★

MICCROLITE

★

MICCROFLEX

★

MICCROLAC

★

MICCROIL

★

KOILKOTE

MICHIGAN CHROME & CHEMICAL CO.
348 EAST JEFFERSON • DETROIT, MICHIGAN

Molded Rubber Goods

Industrial molded rubber goods have been made for many years, and are used in thousands of applications in factories and transportation; yet there has been relatively little written of them to assist those responsible for their purchase.

To aid the industrial engineers, designers, plant superintendents and purchasing agents, *The B. F. Goodrich Company*, Akron, O., has just published an eight-page catalog section on the subject. It is in question and answer form, and designed to supply practical information for those who need guidance in the use, application and development of rubber parts molded to fit specific industrial requirements.

Wire Baskets

The American Wire Form Co., 350 Grant Ave., Jersey City, N. J., has announced the publication of a new folder covering wire baskets used in connection with plating, conveyors and handling of defense parts.

Dust Collecting Systems

The Kirk & Blum Manufacturing Co., Cincinnati, O., are the publishers of a 26-page, spiral-bound book entitled "Dust Collecting Systems in Metal Industries."

The book is fully illustrated with photographs of the company's installations.

Insulated Bushings

The general line of insulated bushings and mountings (designed to stop vibration, absorb shock and reduce wear) that are now available with rubber, rubber reclaim or synthetics as the insulating medium, is described in a new folder and engineering data sheet issued by *Bushings Inc.*, 3442 West Eleven Mile Road, Berkley, Mich.

The folder illustrates the method of manufacturing the bushings and the data sheet, which shows cross sections of 30 of the more typical types of insulated bushings, forms a convenient reference list for the designing engineer.

Rust-Proofing

The Black Bear Co., Inc., 23-01 44th Drive, Long Island City, N. Y., have issued a new folder designed to help war production men who are concerned with rust-proofing.

The folder explains the uses and methods of application of Black Bear Anti-Rust "O," and Black Bear Anti-Rust "I." The "O" compound is designed expressly for outdoor use; Black Bear "I" is recommended for indoor use only. Both types are used for the protection of machine parts, castings, stampings, fabrications, assemblies, etc., for shipment or storage.

Metal Washing Machine

Complete information about the new American Tumbl-Spray Metal Washing Machine is now available in illustrated Circular No. 9 recently published by *American Foundry Equipment Co.*, 555 S. Byrkit St., Mishawaka, Ind.

The new machine is designed for removing chips, dirt, grease, and oil from machined parts, stampings, screw machine parts, etc. By means of its patented endless tumbling conveyor, it achieves complete exposure of work to the cleaning action of the high pressure sprays.

Mechanical features, construction and operating details, and specifications are fully covered in the circular. Schematic drawings and diagrams are included.

Stainless Steels

Recent widespread interest in the "stainless" steels has prompted *Oakite Products, Inc.*, 18 Thames St., New York, N. Y., to publish a 3-page special service report entitled "The Fabrication and Surface Treatment of Stainless Steels." Because of the extraordinary circumstances encountered when working with this class of alloys, the report should prove interesting to metallurgists, works managers, superintendents, master mechanics, shop foremen, designing engineers and tool supervisors.

Typical among the subjects discussed is that of machining "stainless" steel. After pointing out that galling and sizing are apt to occur unless special precautions are taken, the report describes effective tool grinding practices and selection of the proper cutting lubricant. Formulas for lubricating "free machining" grades as well as tough grades of "stainless" steel are given. Rough and finish grinding, as well as deep drawing and forming operations are also discussed with particular emphasis placed on the important role played by lubricants and coolants.

Surface preparation is, according to the report, simplified by the proper application of specialized descaling and degreasing materials. Suggestions on removing lubricating compounds, heat treating scale, shop dirt, etc., between manufacturing operations and before inspection and assembly are concisely given. Copies of the report are freely available on request.

Courses of Instruction

Courses in Aircraft Maintenance

First in a series of wartime courses in aircraft maintenance problems, offered free to the industry, has been completed, according to S. G. Thornbury, technical director of Turco Products, Inc., of Los Angeles and Chicago. Conducted by F. Carl Hirdler, Jr., process engineer, the course is titled "The Turco School of Aircraft Materials and Processes" and requires two weeks to complete.

While U. S. Army Air Corps supervisors comprised the entire student group for the first course, the Turco School is open to executives and operating personnel of all plants throughout the country. New courses will be offered where possible whenever sufficient need arises.

The purpose of the course is two-fold. First, formal lectures, demonstrations and field trips to local war plants give background theory and show metal processing in actual use. Secondly, the school provides opportunity for coordinating research. Problems in aircraft maintainance as presented by plant representatives are given full consideration often resulting in research and the development of new materials according to Mr. Hirdler.

The two-week course includes consideration of the following subjects:

(1) Properties, tests and uses of common metals in aircraft design.

(2) Non-Metallic compounds used in aircraft.

(3) Preparation of metals for anodizing, chromatizing and phosphatizing, with special attention to the processing of magnesium and stainless steel.

(4) Metal plating and other protective coatings for metals.

(5) Metal fabricating, machining of metals, spot-welding and torch-welding.

(6) Paint department, stripping, cleaning and masking of metals, Plexiglass and other plastics.

(7) Assembly, daily cleaning of engines and ship cleaning between overhauls.

(8) Engine overhauling.

(9) Airplane overhauls other than the engine.

(10) Plant maintenance.

We're Both on the Spot . . . Brother!

IT'S all one battle—the roaring dive of a squadron on the target and the precise thoroughness of laboratory and precision manufacturing facilities brought to bear on the one big objective —MORE PRODUCTION!

The battle begins here—*Your problem* is to get even the toughest jobs done ahead of schedule. *Our problem* is to supply the *quality-controlled* materials and methods to meet the production finishing demands of those jobs.

That puts us both on the spot—so, let's fight and work together. Today, as always, we are interested in helping you solve your finishing problems, be they metal, plastic or what-have-you. A laboratory research staff and facilities second to none, working closer than ever with McAleer engineers in the field, are developing new materials, new methods daily, any one of which may be just the solution to your toughest finishing problem.

So, step *off* the spot—let us make a practical demonstration of what McAleer On-the-Job Advisory Service can mean to you in terms of better finish, increased production at less cost. You will not be obligated.

McAleer MANUFACTURING CO.
Quality-Controlled Finishing Materials
ROCHESTER, MICHIGAN

New Books

The Condensed Chemical Dictionary. Third Edition. Completely revised and enlarged under the supervision of Thomas C. Gregory, Editor. Published by Reinhold Publishing Corp. 330 West 42nd St., New York, N. Y. (1942). Size 6¼" x 9¼"; 756 pp. and appendix. Price $12.00.

Over one-third larger than the second edition, this volume has the same general arrangement but over 6,000 new items have been added including chemicals, drugs, pharmaceuticals, chemical specialties, metals, minerals, etc.

A large number of chemical specialties sold under trade or brand names is included together with typical specifications representing descriptions of the products as sold commercially.

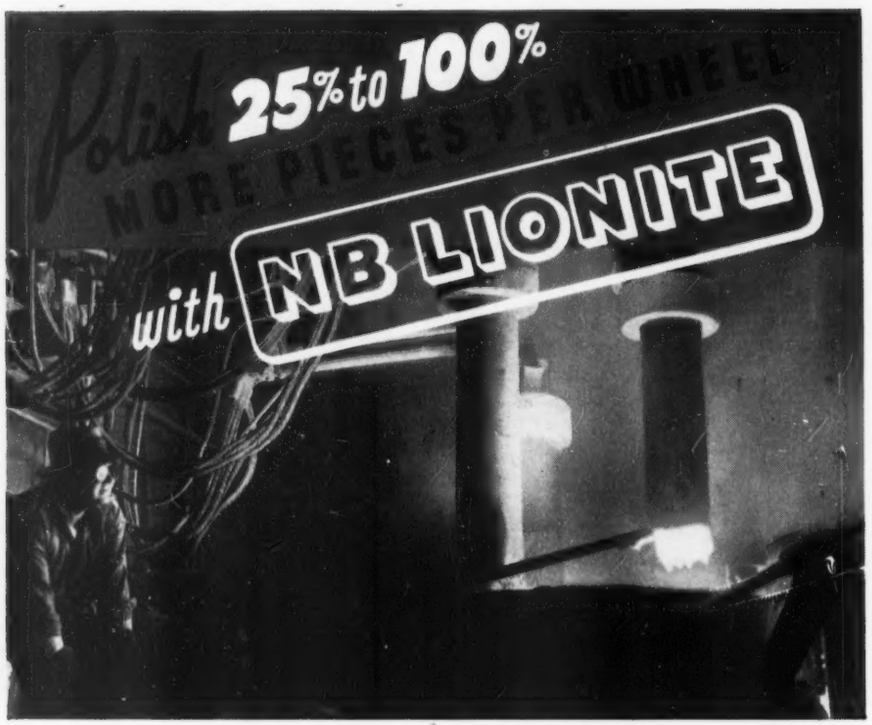
Many companies whose names are familiar to members of the metal finishing industry have contributed the data which make this dictionary an important addition to the plant library.

Circulating Steam Jets

Three new circulating steam jets have been announced by The Duriron Co. Inc., Dayton, O. In addition to being corrosion-resistant these jets are said to have the advantage of fitting snugly to the inside walls of either square or circular tanks, with a maximum projection of 4½ inches.

The suspended and center discharge types may be used in tanks of any depth. The floor type is adaptable for tanks of depth up to 60 inches. All types are designed to give complete agitation and circulation of the tank contents.

Made of the high-silicon iron alloy, Duriron or Durimet, the special stainless steel, they are claimed to be efficient for heating acid solutions, dissolving powdered or lump chemicals, digesting ores and separating sludge acids.



Fusing Bauxite to produce Lionite

ABRASIVE grains are essential materials. They must be conserved as a vital war necessity. But with the demand for higher and higher production, conservation is sometimes sacrificed for speed.

Many manufacturers find, however, that by using NB Lionite for their polishing wheels they get from 25% to 100% more production per wheel. They not only conserve vital material but increase production as well.

NB Lionite is an ideal abrasive to use with cements. Its polyhedral shaped grains with their tough, skarp, cutting points are free from non-productive flats and slivers. They cut fast and wear down slowly.

Aircraft engines, propellers, ordnance material, range finders and innumerable other war supplies are getting to the battle fronts faster because of NB Lionite. Our entire capacity is devoted to producing abrasives for war industries and we welcome the opportunity of increasing the production of those companies not now using NB Lionite. Send us your inquiry.

GENERAL ABRASIVE CO., INC.
NIAGARA FALLS, NEW YORK U. S. A.

Principles of Metallographic Laboratory Practice. By George S. Kehl. Second Edition. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. 1943. Size: 6¼" x 9¼"; 453 pages. Price: $4.00.

Much progress has been made in the electrodeposition of metals since the plater called upon and made use of chemistry, and one of chemistry's tools, chemical analysis. Further progress is in store when the field of metallurgy and one of its tools, metallography, is called upon to the same extent.

In the visual examination of the internal structure of metals with the aid of a microscope, the metal surface must be perfectly flat. The first chapter consisting of 43 pages, describes grinding, polishing and mounting methods for all the common metals. The polishing abrasives and plating procedures used to protect the edges of specimens during polishing as well as the methods of electrolytic polishing as reviewed will be of direct interest to technicians in the metal finishing field.

The principles and procedures of etching the mirror surface of the specimen to show the internal structure are described in the second chapter.

A 38-page chapter on macroscopic (magnification about 10 diameters) examination describes the preparation and examination of specimens for such things as surface defects (seams, inclusions, fractures), uneven structure, segregation of impurities and other irregularities. Special photographic papers placed on the specimens (contact printing) can be made to show the distribution of sulfur, phosphorous and oxides in steels. Platers have used this general method to detect porosity of deposits and the extension of the procedure has possibilities.

In the chapter on methods of testing hardness, the portion dealing with the testing of thin layers is of most interest to platers. The Microcharacter (scratch method), the Herbert Pendulum tester, and the Rockwell Superficial tester are described.

Other sections of less direct interest to the electroplater but written in a manner easy to understand, are titled "Photography" (as related to metallography), "Metallurgical Microscopes", "Special Metallurgical Tests" (such as measurement of grain size, spark and magnetic tests, and the use of X-Rays), "Pyrometry" (measurement of high temperatures) and "Thermal Analysis".

Each chapter is followed by a list of references. The appendix includes 29 pages of tables and data on the reagents and procedures used in electrolytic polishing and etching.

Associations and Societies

The Electrochemical Society Pittsburgh Branch

Electrochemists from all parts of the country and Canada will meet in Pittsburgh on April 8, 9 and 10, with headquarters at the Hotel Roosevelt. Among the scientific-technical sessions there will be one on Dielectrics, another on Corrosion and a third on Automatic Control, each of which has an important bearing on the war effort.

On Thursday, April 8, Dr. Marlin E. Fogle, Weston Electrical Instrument Company, Newark, N. J., will preside over the session on Automatic Control. There will be exhibits in conjunction with this session.

On Friday, April 9, F. M. Clark, an expert in the ever-growing dielectric field and an engineer of the General Electric Co., will preside.

An all-day Corrosion Session follows on Saturday, April 10, with Dr. L. G. Van de Bogart, Crane Co., Chicago, presiding. In the afternoon there will be a round-table discussion on "Combatting Corrosion".

On Thursday evening, the retiring president of the society, Prof. Edwin M. Baker of the University of Michigan, will deliver an address. At that time also the Young Author's Prize and the Book Prize will be awarded to Dr. Sidney Speil, an associate non-metals engineer at the Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn. He and M. R. Thompson, also of U. S. Bureau of Mines, contributed an outstanding paper on "Electrophoretic Dewatering of Clay" at the Nashville Meeting of the society in April, 1942.

On Friday evening, the society will be addressed by George E. Pendray on "Rockets". Mr. Pendray is assistant to the president of Westinghouse Co. and a well-known authority on the subject.

Los Angeles Branch

Ray Bray, foreman of the Crown City Plating Co., Pasadena, Calif., and F. Carl Hirdler, Jr., process engineer of Turco Products, Inc., Los Angeles, divided the speakers' honors at the meeting of Los Angeles Branch, A.E.S., held at Elks Temple on March 1st.

Mr. Bray, a former president of the branch, discussed "Practical Points of Zinc Plating." He presented an informal outline of problems he has encountered on the job and the solutions which he worked out for them, and also described some of the work his company is doing with the new steel-lined zinc tank equipment which it recently installed.

Mr. Hirdler discussed coatings which have been introduced in recent years for rust-proofing iron and steel items. He described early gun blueing practices which, he said, included both the browning or rusting treatment, and the copper oxidation treatment and presented outlines of both methods.

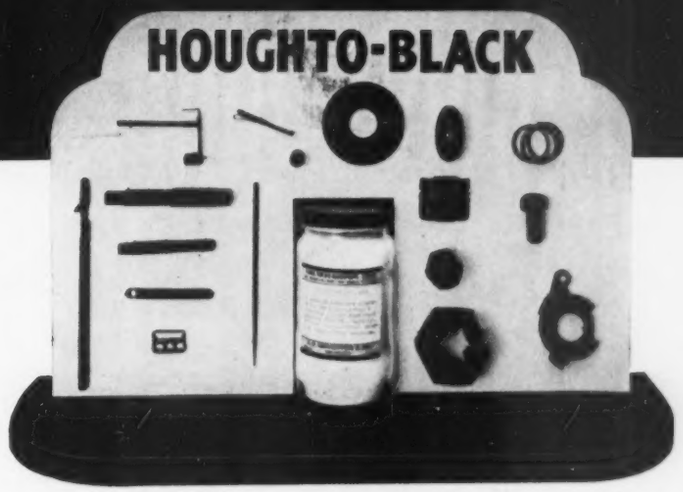
Mr. Hirdler stated that the oxide method of surface treatment has several advantages, viz: Cleaning prior to processing is reduced, as the solution itself acts as a cleaner; complete rinse after processing is not absolutely required, as the film which remains on the surface acts as a corrosion inhibitor on steel.

The speaker also described another type of chemical surface treatment for steel which is gaining popularity, the phosphate method.

Emmette R. Holman, president of the branch, presided. The branch welcomed back to the active list Past President Don Bedwell who had suffered a serious heart attack during February.

The following guests were introduced by Sergeant-at-Arms Stanley Rynkofs: H. A. Bennett, General Electric Co.; F. Brane, E. W. Golden and J. R. Nettle, Phelps-Dodge Corp.; Floyd McKinney and Warren Hamm of Louis Meyer Co.; Al Dekker and Keith Brown of Turco Products, Inc.; V. E. Tuttle, Cadmium Nickel Plating Co.; B. K. Donnelson and Steve Andrews, Vega Aircraft Co., and Tom Turner, A. J. Lynch & Co.

BLACKENING STEEL
on a production basis—with
HOUGHTO-BLACK



• Today, more than ever, with the increasing necessity for (1) protecting steel parts against oxidation, and (2) adapting low carbon steels to uses where high alloy steels were formerly employed but now given over to armament work—HOUGHTO-BLACK fills a real need in the metal industry.

A recent survey of the extent to which this blackening salt is being used revealed these adaptations:

1. Blackening machine gun mounts and fixtures by the ordnance plant of an aircraft company.
2. As a replacement for chrome and cadmium, a tool manufacturer is now blackening his wrenches, hack saw frames, pliers, etc.
3. Another plant, now making gun carriage parts, now HOUGHTO-BLACKENS these parts, including pins and bearings.

The simplicity of the HOUGHTO-BLACK process makes it readily adaptable to the production line. It provides an attractive and protective finish without altering dimensional sizes. Ask the Houghton Man for details or write to

E. F. HOUGHTON & CO.
PHILADELPHIA
Chicago • San Francisco • Detroit

WRITE FOR THIS FOLDER
CONTAINS FACTUAL DATA EXPLAINING
HOUGHTO-BLACK PROCESS

New England Regional Session and Banquet

Complete program for the New England Regional to be held May 1st at the Hotel Bond in Hartford, Connecticut:

Afternoon Session—Starting at 2:00
Metal Finishing Clinic

Moderators—Walter Meyer, Enthone Company; Chick Helmle, G. E. Company.

Talk—By Arthur Zavarella, Materials Engineer, Springfield Armory, Springfield, Mass. Subject—"Ordnance Finishing of Small Arms."

Clinic Experts

1. Henry Strom—Zinc & Cadmium—MacDermid, Inc.
2. Frank Mesle—Silver—Oneida Ltd.
3. Ted Wieczorek—Phosphate Coatings—Stanley Works.
4. Gene Worden—Iron Plating—Stanley Works.
5. Harry Mahlstedt — Hard Chrome—United Chromium.
6. Derick Hartshorn—Black Finishes (all metals)—Enthone Company.
7. John R. Thomas — Anodizing — United Aircraft.
8. Dr. H. Kellner—Burring—Lea Mfg. Co.
9. Howard Donahue — Barrel Finishing — Abbott Ball.
10. G. R. Watkins—Lacquers—Zapon.
11. Harry Sanders — Finishing Uniform Hardware—North & Judd.
12. George Hogaboom—News from Washington—W.P.B.

Ladies Program—all afternoon. Chairman, Mrs. Howard Donahue.

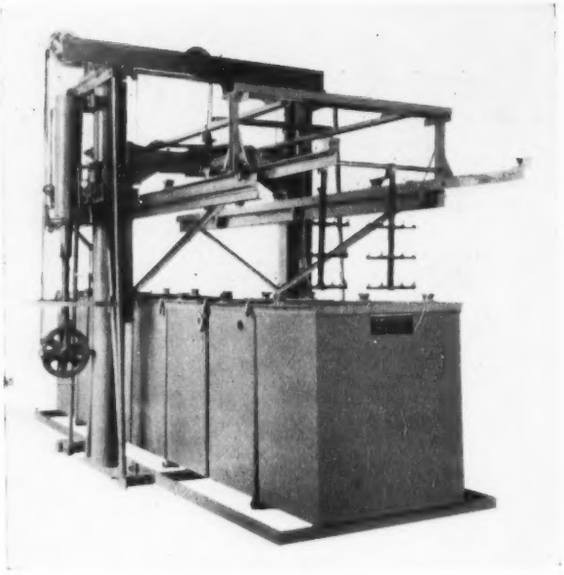
Banquet—7:00 P.M. After-Dinner speaker, U. S. Senator John Danaher from Connecticut.

Entertainment:
Truth & Consequence Program—George Bowes—WTIC.
Comedy—BATEESTE—WTIC.
Music—WTIC.
Dancing until 1:00 A.M.

No serving of liquor in rooms during educational session or banquet.

A Production Conference for the National Metal Trades Association is scheduled for May 26th and 27th at the Palmer House in Chicago.

Crown Pick-up Unit



...MACHINE...

A UNIT TYPE TRANSFER CAPABLE OF HANDLING SEVERAL TANKS AT ONE TIME.

●

...USE...

FOR A SERIES OF OPERATIONS WHERE THE WORK MUST PASS THROUGH SEVERAL TANKS, AS THE CLEANING AND RINSING OPERATIONS, FOR A SEMI-AUTOMATIC PLATING TANK.

CROWN RHEOSTAT & SUPPLY CO.
1910 MAYPOLE AVENUE :-: :-: CHICAGO, ILLINOIS

McKeon's

"Liquid Sulphur"
TRADE MARK REG'D

Strips Copper Plate

The Stream-lined Way

Safe for All Base Metals

Write for Sample and Advice

SULPHUR PRODUCTS CO. Greensburg, Pa.

News From California

By Fred Herr

To make room at its Culver City, Calif., plant for work on the great super cargo plane being developed by Howard Hughes and Henry J. Kaiser, *Hughes Aircraft Co.* has moved several departments from Teale and Florence Aves., Culver City, to various sections of Los Angeles.

The armament division, and with it the plating department employing 10 men, has been moved into leased quarters at Sycamore Ave. and Santa Monica Blvd., Hollywood, and the Duramold division has been transferred to the firm's branch plant at 6235 Saint Andrews Place, Los Angeles.

With the removal of the plating department to Hollywood, the company has installed new zinc and silver set-ups and Dulite equipment for work on machine gun parts and cartridge belts. *A. A. Sulzinger* has been appointed assistant superintendent of the Hollywood plating department.

Memley Plating Works, 5966 S. San Pedro St., Los Angeles, has completed installation of a new barrel plating room to handle its increased activity in barrel plating of defense plants.

The new equipment consists of eight plating barrels and two ball burnishing barrels, plus the necessary generators, water tanks, dryers and other auxiliary equipment, all of which was supplied by the Los Angeles branch of *Chas. F. L'Hommedieu & Sons Co.*

Max Golden, formerly plating room foreman for the now inactive Trophy Craft, Inc., of Los Angeles, has joined the finishing room staff of Memley Plating Works.

Frieden Calculating Machine Co., San Leandro, Calif., has acquired a new aluminite set-up, complete with sealer tanks and rinse and cleaner tanks for work on tachometers and bomb fuses.

Installation has been completed on three 10 foot tanks with capacities ranging from 300 to 600 gallons, and on three py-aluminum tanks, six feet long with a capacity of 300 gallons, for special finishes on specified defense items.

The new equipment supplements a small cadmium tank which the firm has had in operation for some time.

The Phelps-Dodge Co., 6100 Garfield Ave., Los Angeles, reports that it obtains treble the life out of dies and other tools used in its plant by the use of chrome plate applied in its own finishing shop. The company operates a small metal finishing room equipped with a *Hanson-Van Winkle-Munning* set-up, including a 260-gallon chrome-tank. *F. B. Brane,* plating room foreman, reported that the firm's practice is to apply 0.002" chrome plate on circular dies, with the hard chrome applied directly on the steel. This process, he reported, has been highly effective in increasing the life of equipment.

D. M. Bedwell, head of *Bedwell Plating Co.,* 1344 West Slauson Ave., Los Angeles, has recovered from a heart attack which necessitated his hospitalization in mid-February.

Gene Ryncofs, son of Marcus Rynkofs, head of *Liberty Plating Co.*, 525 N. LaBrea Ave., Los Angeles, now serving with the Marine Corps in the Hawaiian Islands, appears to be following Capt. Eddie Rickenbacker's road to fame and glory. Rickenbacker's first job with the A.E.F. in 1918 was as General Pershing's chauffeur in France. Gene, his father reports, is chauffeur for the Marine Commander of the Hawaiian area.

The rebuilding of worn motor parts by spray application of new metal and remachining is becoming top news in truck maintenance and metal finishing fields in California.

Reported as typical is the activity of the *DuFrane Machine and Engine Works*, Oakland, probably the largest Northern California firm doing metal spraying. The company is handling an increasing number of motor trucking and bus jobs in California and is also reported drawing work for metal spraying from Washington, Montana and other states.

E. H. Santos of the DuFrane Co. declared that their out-put in January, 1943, was not only the biggest in the history of the firm but that it was nearly double that of January, 1942.

Their largest single work classification in metal spraying, Santos declared, is on crankshafts, followed by camshafts and transmission shafts. At present, increasingly numerous small equipment parts, such as water and oil pumps, are being sent in for rebuilding through metal spraying.

John Merigold, operator of a silver and gold plating shop in downtown Los Angeles, in March completed his second expansion move since opening the plant last summer.

Mr. Merigold moved his equipment from the fifth to the tenth floor of the 424 South Broadway Building and now has some 2000 square feet of space in two adjoining rooms for plating, which at present consists mainly of work on Signal Corps items.

M. P. Silver, manufacturer of cast silver products, for whom the Merigold shop does considerable silver polishing, has also moved to enlarged quarters on the tenth floor of the same building.

For illegally melting war-restricted aluminum, the High Duty Products Co., 1801 S. Hope St., Los Angeles, was fined $1200, and William B. Huber, president of the firm, was fined an additional $500 following filing of a plea of nolo contendere (guilty in fact but with no deliberate criminal intent) in Federal Judge Leon R. Yankwich's court, Los Angeles, in February.

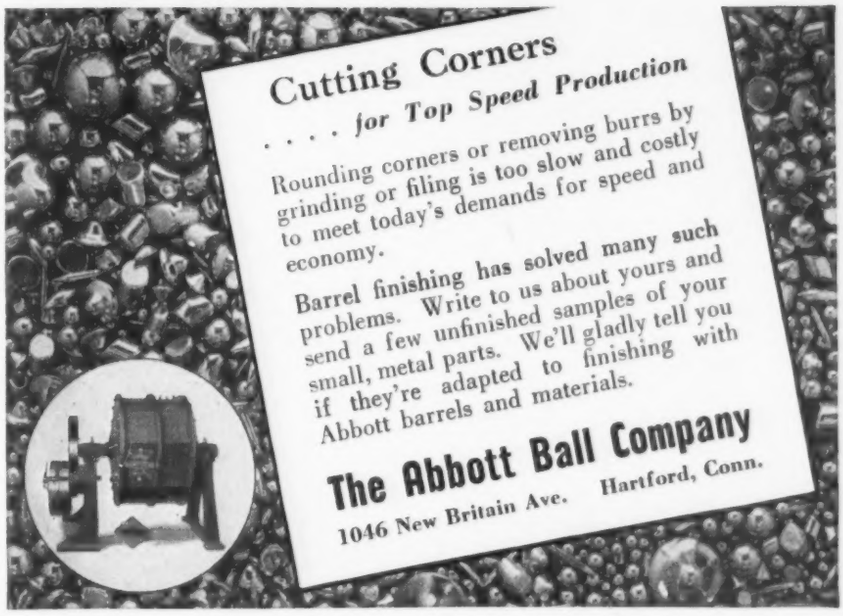
Investigation by the War Production Board's compliance division revealed that the company had converted the aluminum to non-war uses in violation of WPB conservation orders.

Production of minerals and metals in California in 1942 exceeded the 1941 out-put by $5,157.000, reaching a total value of $379,483,000, according to a report by California State Mineralogist *Walter Bradley*.

CONTROL AND VALVE
FINISH
COLD RINSE
BLACK-MAGIC
HOT RINSE
ALKALI
Black-Magic
MAKES One BATH
DO THE WORK OF Two!
BLACK-MAGIC is a low temperature salt bath process for black-finishing all types of non-stainless steel.
BLACK-MAGIC—unlike ordinary coloring processes—requires only "one bath" to produce a rich blue-black finish which is rust-inhibiting, cannot be rubbed off, will not fade, chip or peel!
BLACK-MAGIC achieves savings as high as 60% over the "two bath processes", yet every test made indicates an equal depth of penetration and a better color.
MITCHELL-BRADFORD CHEMICAL CO.
BRIDGEPORT, CONN.

Write for complete portfolio describing the revolutionary coloring method, and other BLACK-MAGIC Products.

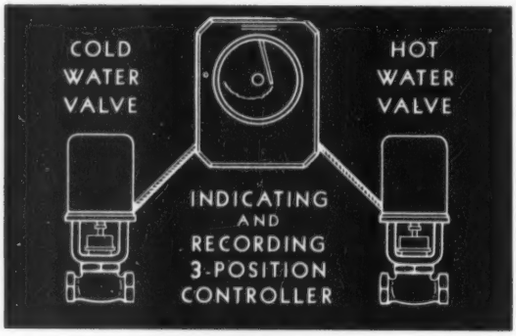
Accepted on Ordnance and other Government contracts calling for black oxide finish.


Cutting Corners
. . . . for Top Speed Production
Rounding corners or removing burrs by grinding or filing is too slow and costly to meet today's demands for speed and economy.
Barrel finishing has solved many such problems. Write to us about yours and send a few unfinished samples of your small, metal parts. We'll gladly tell you if they're adapted to finishing with Abbott barrels and materials.
The Abbott Ball Company
1046 New Britain Ave. Hartford, Conn.

AUTOMATIC CONTROLS for INDUSTRIAL EQUIPMENT

BARBER-COLMAN CONTROL SYSTEM

FOR MAINTAINING UNIFORM TEMPERATURE OF ANODIZING BATHS...



This automatic control system provides a simple, economical, and dependable means for maintaining the required temperature in anodizing baths. As the drawing shows, it uses two Barber-Colman two-position electric motor-operated valves governed by a standard 3-position indicating and recording controller. If the bath temperature is low, the valve admitting hot water to the coil opens; if the temperature gets high, the cold water valve opens; when the bath is right, both valves are closed.

MAXIMUM SERVICE Controls BARBER-COLMAN COMPANY MINIMUM MAINTENANCE

Write for Bulletin "CONTROLS for INDUSTRY"

BARBER-COLMAN COMPANY 1205 ROCK STREET ROCKFORD, ILLINOIS

ACCURATE • DEPENDABLE • DURABLE • ECONOMICAL

COLOSSUS PRODUCTS HELP IN WAR PRODUCTION

• American Industry some time ago converted from civilian to war-time production. Colossus Brand products kept pace with the change and we are anxious to work with you on any finishing problems that arise in *your conversion*. James H. Rhodes & Company is grateful for the many commendations received from war goods producers.

COLOSSUS BRAND*
WHITE SPANISH FELT WHEELS & BOBS are made in a full range of diameters, thicknesses and densities to meet your specific polishing requirements.

COLOSSUS BRAND*
DICARBO (*Silicon Carbide*) **and ALUMINIDE** (*Aluminum Oxide*) **ABRASIVE GRAINS** are offered as a working companion with Felt Wheels and Bobs. Great care is given to insure consistent grading, maximum capillarity and extreme hardness.

COLOSSUS BRAND*
POWDERED & LUMP PUMICE have the right combination of body, weight, abrasive quality and purity for correct, faster metal finishing — for facing and dressing jobs.

** Colossus Brand products stand for four decades of manufacturing, mining and milling experience.*

JAMES H. RHODES & COMPANY
157 W. Hubbard St., CHICAGO, ILL. • 48-02 Twenty-Ninth St., LONG ISLAND CITY, N. Y.

For further information write for our latest catalogs

Principal substances which showed increases over the previous year's out-put were petroleum, natural gas, cement, stone, borates, potash, quicksilver, tungsten, chromite manganese ore, iron ore, lead and zinc.

Tycrete Products Corp., Beverly Hills, Calif., has signed contracts for the Brown magnesite deposit of 640 acres, 12 miles west of Needles, Calif. The transaction involved purchase of ore production in excess of $1,000,000, *Mitchell I. Liebensohn*, executive vice-president of Tycrete Products Corp., announced. Liebensohn disclosed that the property has been explored by a number of open cuts which exposed a huge deposit of commercial grade magnesite, specimens of which are reported to have sampled at 90 per cent. The firm has a 150-ton plant for treatment of magnesite in operation at Chula Vista, Calif.

The Mining Association of the Southwest, with headquarters in Los Angeles, has sent to the Efficiency Committee of the California Legislature (which reconvened on March 8 at Sacramento) a statement to the effect that it favors abolition of the Bureau of War Mineral Production at Sacramento, and any and all other political or semi-political bureaus and agencies which seemingly duplicate duties already discharged either by the California Division of Mines or some other long-established agency.

The Mining Association also went on record as opposing the Seawell Bill, which was designed to abolish the State Division of Mines and set up a new department of mines.

California State Chamber of Commerce's mining division also announced opposition to the Seawell Bill and to another measure designed to strip the State Division of Mines of its fund for publishing reports and periodicals, and to two other measures which would sidetrack the present state mineralogist and place the appointment in the hands of the governor or the State Mining Board.

C. S. Wendrick of Chicago announced at Los Angeles in March that the *Steel Service & Sales Co.* plans immediate construction of a 50-ton tin concentrator at the Evening Star mine, 10 miles north of Cima. Owned by *Hiram Whistler* and *Vaughn Maynard* of California, the group of claims bearing the name Evening Star are under lease to the Chicago organization headed by Wendrick.

Arrangements are reported to have been concluded by the U. S. Bureau of Mines for comprehensive drilling of several copper properties near Copperopolis, Calif., including the once highly productive Penn mine. Test holes will be drilled to 1000 feet. The Penn was operated on a large scale some years ago and was one of the leading copper producers of Calaveras County.

Mining of commercial ore also is reported from the Napoleon mine, reopened last summer by *Mountain Copper Co., Ltd.*, a British corporation. The Napoleon is likewise situated in the Copperopolis district. New productive ground has been developed and new equipment is being installed.

Business Items

Joshua Hendy Iron Works, Sunnyvale, Calif., recently absorbed the *Crocker-Wheeler Electrical Manufacturing Co.* of Ampere, N. J. Executive control is centered on the West Coast.

The Crocker-Wheeler properties in New Jersey and the Hendy properties in California are to be expanded.

In addition to war materials, standard products of Crocker-Wheeler include polyphase induction motors, synchronous motors, d. c. motors, a. c. and d. c. generators and motor generator sets.

The Hendy organization produces marine engines at present and plans to add turbine production to its activities.

The first American Red Cross First Aid Detachment to be organized in an industrial plant under the auspices of the Passaic, N. J., Chapter has been formed at the plant of *The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.* The Passaic Chapter has supervision over Red Cross activities in the busy industrial communities of Passaic, Garfield and Wallington.

The detachment is designed to function in disasters of any nature, including bombings, sabotage, explosions, fires and floods, and would assist the plant doctor and hospital staff. Ordinarily it would not leave the Manhattan plant. However, in the event of an air raid causing many casualties in other localities, the Manhattan squad would be available for emergency calls.

The Magnus Chemical Co., Inc., Garwood, N. J. has announced the appointment of *J. D. Holmes* as manager of its newly organized Feedwater Treating Division.

Mr. Holmes has had much experience in the treatment of feedwater, having covered all types of stationary plants, railroads and steamship lines throughout the United States, Canada and the West Indies, under widely divergent conditions.

He is developing the Feedwater Division of the Magnus Chemical Company along the latest accepted lines, approved by the chemical and engineering authorities. Analytical methods and control features are being brought into such simple form that any engineer or fireman may maintain as accurate control over all adverse conditions found in his plant as would a trained technician.

One of the unique parts of the Magnus Feedwater Treating plan is loaning to its clients of the chemical water testing equipment needed for the maintenance of perfect control, and the furnishing of all chemical testing reagents and indicators free.

Another feature is the Graph Chart Control. This is a system of recording results of water analysis on a special chart upon which maximum and minimum tolerances of each element to be controlled are established.

Speed ACID PICKLING the DOUBLY SURE* Way with Enthone Acid Addition Agent

★ FASTER PICKLING — the acid rapidly penetrates under rust and scale, thus LIFTING THEM OFF!

★ SAVES ACID — Drag-out is materially reduced and acid is saved by inhibiting action.

OVERCOMES WATER-BREAK IN PICKLING — Due to poor alkaline cleaning or soap in the alkaline cleaner, water-breaks appear on acid dipping before plating. The use of ENTHONE AAA in the acid literally makes the acid a cleaner and overcomes peeling due to faulty cleaning.

Write today for FREE Trial SAMPLE and valuable informative BULLETIN

THE *Enthone* COMPANY
NEW HAVEN CONNECTICUT

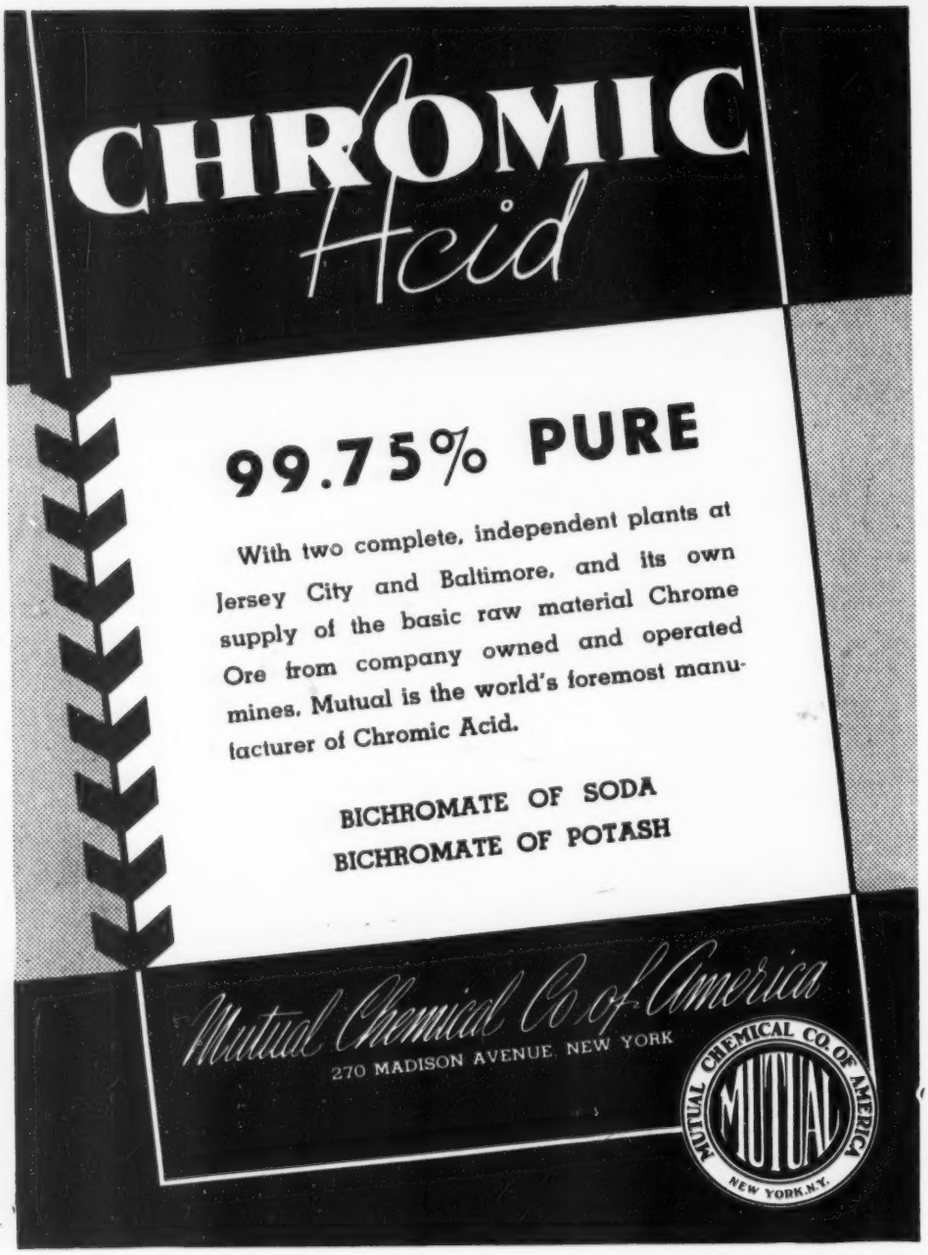
HARD CHROMIUM *Solutions*

Can be controlled with simple direct reading test sets.

Test sets for other solutions and deposits immediately available.

Write for Leaflets

KOCOUR CO.
4720 S. CHRISTIANA AVE.
CHICAGO


CHROMIC
Acid
99.75% PURE
With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines. Mutual is the world's foremost manufacturer of Chromic Acid.
BICHROMATE OF SODA
BICHROMATE OF POTASH
Mutual Chemical Co. of America
270 MADISON AVENUE, NEW YORK
MUTUAL CHEMICAL CO. OF AMERICA
MUTUAL
NEW YORK, N.Y.

NOW
IS THE TIME FOR SPEED-PRODUCTION
AND
VICTORY TO HELP ACHIEVE THIS END

USE 4A PRODUCTS

4A CEMENT and THINNER Used for setting-up wheels, belts, buffs, rolls—they are free cutting, long lasting and economical when set up with 4A Cement.

COLORING ROUGES Uniform, carefully graded raw materials, expertly compounded by Harrison's technicians, insure rouges that give high luster and faultless finishes.

POLISHING COMPOUNDS 4A symbolizes SUPERB PERFORMANCE, which you will find in our compounds for CUTTING, CUT AND COLOR, AND MIRROR FINISHING all kinds of steel including stainless steel, carbon steels and hard-to-buff alloys.

SAMPLES ON REQUEST

HARRISON and COMPANY
HAVERHILL, MASS.

Handy & Harman of New York, fabricators of silver and gold alloys, have announced the opening of a Los Angeles office.

The company states that the need for this office was brought about principally by the rapid growth in the use of their silver brazing alloys Sil-Fos and Easy-Flo in the construction of ships and airplanes. *H. A. Folgner*, connected for many years with the company's Brazing Engineering Division in New York, has charge of the office, which is located in the Bendix Building, 1206 South Maple Avenue, Los Angeles. From this location the company will be in a position to improve their service to shipyards, airplane plants and other factories and to cooperate more closely with dealers on the West Coast. The new office also provides a service headquarters for those using gold and silver in making products for the arts.

Dean A. Powers, electrical engineer, has been appointed to the research staff of *Battelle Memorial Institute*, Columbus, O., where he will assist in electrochemical and electrometallurgical research.

Powers, a graduate of the University of Toledo, was formerly an engineer for the Public Utilities Commission of Ohio. He is an associate member of the American Institute of Electrical Engineers.

As a result of experiments conducted in its laboratories, *Minnesota Mining and Manufacturing Company*, St. Paul, Minn. have been called on to help make enough synthetic rubber to produce 4,200,000 automobile tires and tubes annually.

Together with four well-known tire and rubber concerns, Minnesota Mining and Manufacturing Company and its subsidiary, the Inland Rubber Corporation of Chicago, each year will make up to 30,000 long tons, more than 60,000,000 pounds, of synthetic rubber of the butadiene-styrene-copolymer type in a $6,000,000 government-owned plant nearing completion in Kentucky.

The companies have banded together and formed the National Synthetic Rubber Corporation and will pool all their rubber knowledge, as well as all knowledge obtained during the life of the project. Technical staffs will be supplied in approximate proportion to their size and range of occupation by the various companies.

General manager of the plant will be *Dr. P. J. Oakes*, production manager of Minnesota Mining and Manufacturing Company's waterproof sandpaper and resins division. The rubber will be allocated by the government throughout the nation to replace natural rubber from sources lost in the war to date.

This is the second time the 3-M Company has been called upon by the government to do direct war work. The first was to construct and operate a plant adjacent to its roofing granules plant at Copley, O., for the manufacture of oleum, or 109% fuming sulphuric acid, which is used in the manufacture of explosives. Sale of this product is made direct to the U. S. Ordnance Department.

James J. Manderscheid

James J. Manderscheid, head of James J. Manderscheid and Associates and for 13 years president of Advance Polishing Wheels, Inc., is now representing various manufacturers of finishing materials and equipment from his Chicago office at 5118 No. Menard Avenue.

Mr. Manderscheid started in the metal finishing field in 1906 and has been actively connected with it ever since. He has made many contributions to the industry, his latest feat being the introduction of an automatic system of burring gears.

Due to the necessity of interchanging information directly concerned with facilitating and speeding up production of ordnance material and other essential war supplies, the 2nd War Production Conferences of *Oakite Products, Inc.* were held concurrently in New York, Chicago, Detroit and Memphis in February.

Highlighting the two-day programs of each Division Conference was a review of technical data dealing with currently used time and manpower saving techniques for handling such war production operations as pickling, degreasing and preventing rust on steel shells; cleaning gun carriages, mounts and turrets; cleaning tools, dies, gun and torpedo parts before electroplating; cleaning before black oxide finishing, Parkerizing, Bonderizing, the Bullard-Dunn Process and other special surface treatment processes; preparation of aluminum and magnesium before anodizing; the Dow No. 7 treatment, Alroking, painting and similar operations. In addition, the use of Oakite materials in machining, grinding, drawing, stamping, burnishing and tumbling was discussed at considerable length.

Robert C. Stanley, chairman and president of *The International Nickel Company of Canada, Ltd.*, has announced the election of *John C. Traphagen* and *Robert L. Beattie* to membership on the board of directors of the company.

Mr. Traphagen is president of the Bank of New York. He is American trustee of the Sun Insurance Office, Ltd., and a trustee of the Mutual Life Insurance Company of New York. His directorships include the Board of the Baltimore and Ohio Railroad. He is also a trustee of Stevens Institute of Technology and of Rockefeller Institute for Medical Research.

Mr. Beattie has been in the services of the company at Copper Cliff since 1911 with the exception of a three-year period in the last World War when he was overseas with the Royal Canadian Engineers. He was awarded the Military Medal by Canada. He became assistant general manager in Canada in 1935, assistant vice-president in 1940, and vice-president and general manager in December 1942.

Laminated Shim Co., Inc., Glenbrook, Conn., manufacturers of Laminum shims and shim stock and An-cor-lox self-locking nuts, have announced the retirement of *Earl L. Young*, vice president in charge of production. Mr. Young had been with the company 22 years, since February 1, 1920, and was in charge of production to the date of his retirement.

No longer need plating, degreasing, washing or other processing in metal finishing plants depend on rule o' thumb!

Neither is it necessary any longer to make heavy investments for intricate control equipment, difficult to keep in day-by-day operation.

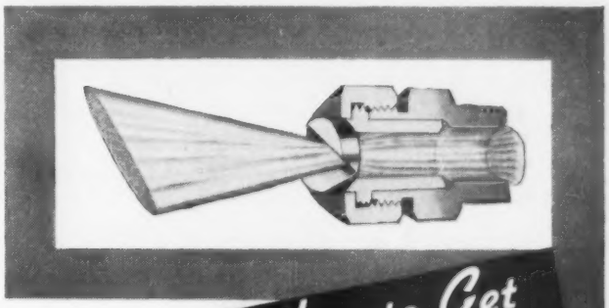
Sarco has demonstrated in hundreds of plating plants that very simple, inexpensive controls can do the work — when correctly selected and applied.

Three distinct types are available, tailored to the job and ranging from combination trap controls for small tanks, to electric control for chromium plating, where temperatures are held within 1°F. Ask for the bulletins on Sarco Steam Traps and Control for metal plating and finishing.

159

SARCO SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.



No cores or vanes in this flat spray atomizing nozzle. Wearing parts are easily renewable and cost little.

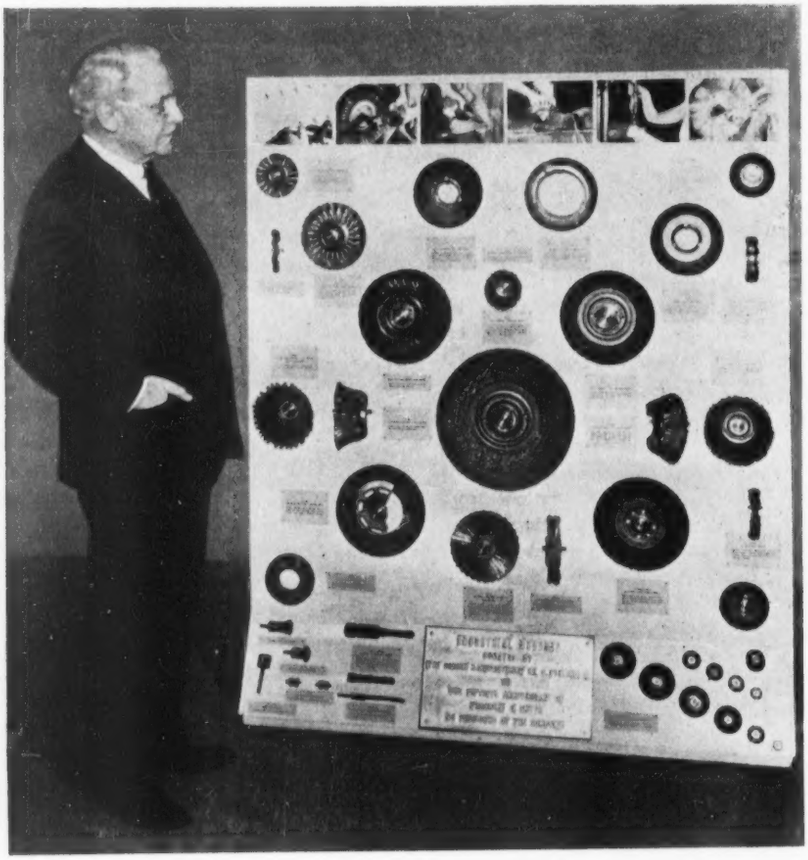
How to Get BETTER RESULTS In Spray Operations

Spray nozzles do better, faster work, more economically, when engineered for the jobs they do. Since the many types and sizes of Spraying Systems nozzles *are* engineered, they save time, power and material. For example, if your process requires a flat spray using 3.5 GPM at 20 lb. water pressure with an effective spray angle of 25°, the right Spraying Systems nozzle will do the job in just that way.

Our engineers make cost-free recommendations — offer valuable suggestions concerning *your* spraying problems. Write and describe your spray operations — you'll receive prompt attention.

SPRAYING SYSTEMS COMPANY
4039 West Lake Street Chicago, Illinois

SPECIALISTS IN THE DESIGN AND MANUFACTURE OF SPRAY NOZZLES



Smithsonian Exhibit Shows 70 Brushing Wheels Which Aid in War Production

Approximately 70 distinct types of brushing wheels have been assembled for a permanent exhibit in the Smithsonian Institution at Washington by *The Osborn Manufacturing Co.*, Cleveland, O., manufacturer of industrial brushes.

All 70 of the wheels and many more like them have gone into service for the United States to help war industries in the brushing of metals and other materials.

The exhibit shows the development of brushing wheels during the last 50 years. It shows the brushing wheel in most common use at that time—a wheel consisting of wire radiating from a block of wood. These brushes, mounted on shafts driven by steam power, were used chiefly by electroplaters and jewelers.

The brushes exhibited are in three general forms—radial, cup and end brushes. They are rotated on chucks, headstocks, grinding heads, power hand tools or flexible shafts. The exhibit is assembled on two panels to be erected in a glass case.

At the left, *Franklin G. Smith*, president of *The Osborn Manufacturing Co.*, is shown viewing one of the exhibit panels.

PLATING RACKS

by Joseph Novitsky

- We specialize in plating racks of our own patent.
- Constructed without screws, rivets, solder, brazing, welding.
- We design racks to suit your individual problem.

JOSEPH NOVITSKY

Office: 104-35 199th St., Hollis, L. I., N. Y.
(Phone—Hollis 5-6871)

Factory: 79-20 Jamaica Ave., Woodhaven, L. I., N. Y.
(Phone—Virginia 9-9239)

SIZED TO YOUR REQUIREMENTS!

Years of experience acquired in manufacturing copper sulphate for industrial use has taught us that the following 6 forms of our product will meet the requirements of practically every consumer.

1 LARGE CRYSTALS
2 SMALL CRYSTALS
3 GRANULATED
4 SUPER-FINE
5 "INSTANT"
6 MONOHYDRATED (Full 35% Metallic Copper Content)

NICHOLS COPPER SULPHATE

TRIANGLE BRAND

99% + PURE

Nichols Copper Sulphate has been standard in the chemical industry for over fifty years. It is the oldest and best known brand name associated with copper sulphate. Made in accordance with modern manufacturing methods, you are assured of never-failing high quality in every shipment. Write today for full information on Nichols Copper Sulphate.

COPPER OXIDE (Red) NICKEL SULPHATE

MADE BY
PHELPS DODGE REFINING CORPORATION
Refiners of Electrolytic Copper
Offices: 40 Wall St., New York, N. Y. 230 N. Michigan Ave., Chicago, Ill.

Bristol Company Appointments

L. G. Bean

Howard H. Bristol, president of *The Bristol Co.*, Waterbury, Conn., manufacturers of automatic control and recording instruments, recently announced the appointment of *L. G. Bean* as vice-president in charge of engineering and sales. Mr. Bean had been vice-president and general sales manager since 1939. He became associated with the Bristol Company in June, 1920, as sales engineer. In 1921 he became district manager of the company's Boston district; in 1925 he was made Chicago district manager; in 1930 he returned to Waterbury as assistant chief engineer and in 1935 became sales manager.

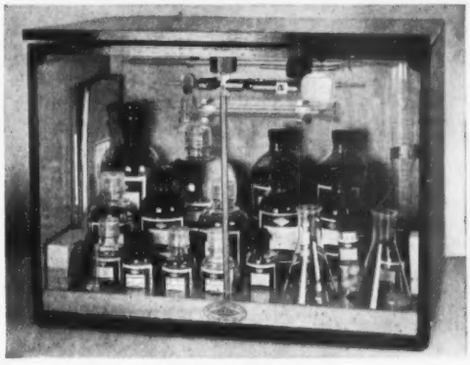
E. L. Stilson

E. L. Stilson, who has also been with the organization since 1920 and who has been associated with the field engineering department since 1940, was appointed assistant sales manager.

Harry E. Beane was named sales manager of the company. Mr. Beane joined the sales engineering department of Bristol in 1920 and was appointed district manager of their Birmingham, Ala., office in 1925. In 1930 he became district manager of the Pittsburgh district and in 1938 was promoted to supervise the activities of the company's branch factories at Chicago, Akron and San Francisco.

H. E. Beane

LaMOTTE CONTROL EQUIPMENT
for the
ELECTROTYPER and ELECTROPLATER



LaMotte Outfit for the Control of Acid Copper, Cyanide Copper, Acid Zinc, Cadmium, Brass and Bronze Plating Solutions.

Here is a compact unit which contains all necessary calibrated glassware, reagents and full instructions for making each test listed above. A specially designed working-cabinet is furnished in which the glassware and reagents are stored in their separate compartments offering the utmost in convenience and simplicity.

Other LaMotte Control Outfits are available for determining Chlorides, Nickel Content, Iron Content, Acid or Copper Content, the acidity and alkalinity of nickel, zinc, tin or cyanide baths.

Write for further information.

LaMOTTE CHEMICAL PRODUCTS CO.
Originators of the Practical Application of pH Control
DEPT. MF TOWSON, BALTIMORE, MD.

ROLOCK
PROCESSING CARRIERS

FASTER ANODIZING

FOR ALUMINUM AIRCRAFT RIVETS

Because of its larger-than-usual capacity (5" dia. x 13" height) this specially constructed Rolock basket speeds the anodizing of aluminum rivets . . . handles them easily. Whatever your needs for baskets, crates, trays, racks or other processing carriers, **Rolock** engineers will design the correct size and shape and build them from materials which will withstand any thermal exposure, acids or gases . . . and handle loads from a few ounces up to 6000 lbs.

ASK ROLOCK FOR RECOMMENDATIONS

ROLOCK, INC.
1300 Kings Highway East, Fairfield, Conn.

"Pur-Blac"

The Black Oxidized finish that penetrates Iron & Steel Surfaces

•

ECONOMICAL Inexpensvie equipment with minimum procedure.

CORROSION RESISTANT Will stand a 100 hour salt spray test.

NO CHANGE IN DIMENSIONS Parts remain same size after treatment.

NON-TECHNICAL Temperatures not critical. Analytical control not necessary.

PERFECTLY UNIFORM Beautiful ebony finish maintained throughout.

Write for descriptive folder

THE PURITAN MFG. CO.
Waterbury, Conn.

1,000th Manhattan Rubber Employee Goes Into Armed Forces

John Edward Mucha, of Garfield, N. J. had the distinction of being the 1,000th employee of *The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.*, Passaic, N. J., to enter the armed forces.

Private Mucha was inducted February 3 by Local Board No. 8 of Garfield and left for Fort Dix on February 10. He was employed in the Wrapped Tubing Department at the Manhattan plant.

To date, 1,003 Manhattan men out of a total of 39,000 employees are serving in the armed forces. This is an average of one man in uniform for every 39 persons employed and is believed to be a record for industrial plants in the busy Passaic area.

McGean Chemical Co. suffered an estimated loss of approximately $15,000 in a fire which started in its coating building at 2910 Harvard Ave., Cleveland, O.

FOR
HARD CHROMIUM
USE
ZIALITE
ADDITION AGENTS
to obtain

1. Finer grain structure
2. More durable plate
3. Smoother heavy plate
4. Greater throwing power
5. Less sensitivity to sulphate ratio.

Send a sample of your present bath to see if it is suitable for conversion to this improved formula.

ZIALITE CORPORATION
143 Exchange Street
Worcester, Mass.

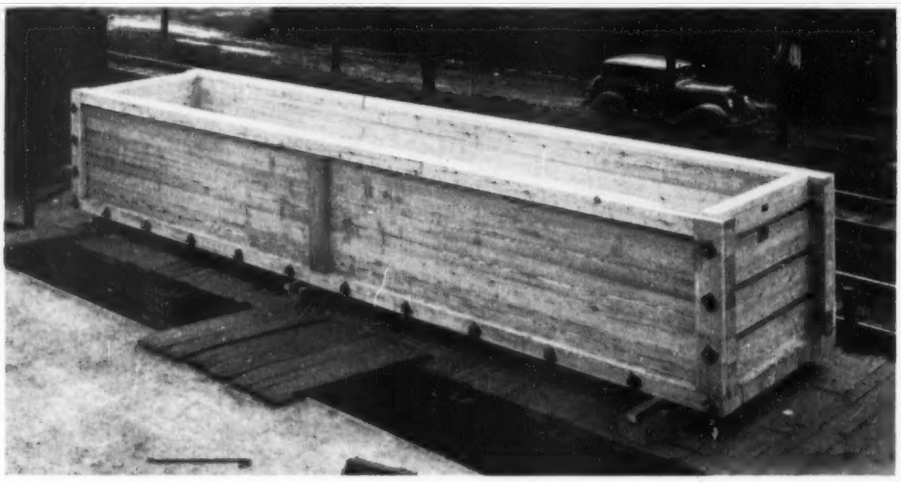
INSULATED PLATING RACKS
Special and Standard Sizes
For all parts regardless of shape. We specialize in your rack problem.
STANDARD PLATING RACK CO.
1925 N. Paulina St.
Chicago, Ill.
ARMITAGE 6766

CADMIUM — ZINC — BRASS COPPER PLATING
SCREWS — RIVETS WASHERS—SMALL PARTS, ETC.
Quotations furnished promptly upon request.
SIMPRO CORP.
39 Ave. L, Newark, N. J.

BUFFS, CLEANERS
BUFFING COMPOSITIONS NICKEL ANODES CHEMICALS AND GENERAL SUPPLIES
JACOB HAY COMPANY
4014 W. Parker Avenue
Chicago, Ill.
Albany 2742

RIBBON ZINC
For stamping and drawing
FUSE METAL
For fuse elements
ZINC WIRE
THE PLATT BROS. & CO., Waterbury, Conn.

SPEED PRODUCTION—CONSERVE CRITICAL METAL
NICKEL, CHROMIUM, BRASS OR COPPER
Electro-Bonded SHEETS · COILS TO ZINC, STEEL, BRASS, COPPER, ALUMINUM OR TIN PLATE
AMERICAN NICKELOID COMPANY - 8 Second St. Peru, Illinois



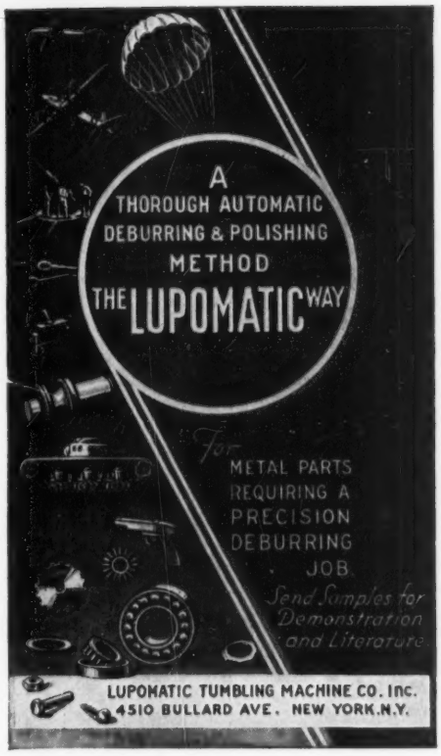
We can give excellent service on all types of

WOOD TANKS

The shortage of metals has increased the demand for wood tanks for plating and pickling service. We can give excellent service on all types of tanks. Send us your inquiries.

★

KALAMAZOO TANK & SILO CO.
KALAMAZOO, MICHIGAN



Can You Supply Any of These Products?

We have received an inquiry regarding sources and prices of the following items and materials: Single Nickel Salts; Double Nickel Salts; Boric Acid; Ammonium Chloride; Nickel Chloride; Depolarized Nickel Anodes 99%; Tripoli Composition Grade B-5; Chromium Coloring Composition Grades E-L-23 and 6-M-107; White Coloring Composition Grade XXX White; Crocus Composition Grades C-100 and C-200; Monarch Wheels 8" Diameter, 1½" face, arbor hole ¾"; Triplex Wheels 8" Diameter, 1½" face, arbor hole ¾"; Sheepskin Polishing Wheels Diameter 8", face 1½", arbor hole ¾"; Sheepskin Polishing Wheels Diameter 6", face 1", arbor hole ¾"; Felt Wheel Diameter 8", face 1½", arbol hole ¾", Grade medium; Felt Wheel, diameter 8", face 1", arbor hole ¾", Grade medium; Buffs 1" Spiral Sewed Buff Diameter 8", arbor hole ¾"; Buffs ¼" Spiral Sewed Buff Diameter 8", arbor hole ¾"; Concentric Sewed Buff Full Disc Buff 8" face, arbor hole ¾"; Safety Steel Wire Brushes, Diameter 8", arbor hole ¾" No. 21108; Safety Steel Wire Brushes Diameter 6", arbor hole ¾", No. 21106; Turkish Emery No 200.

Readers having these items available are advised to get in touch with Moises A. Garcia G., Direccion Gral de Estadistica, Ciudad Trujillo. R. D.

VULCAN SODIUM STANNATE

Manufactured by

THE VULCAN DETINNING CO.
SEWAREN, N. J.

Under Patents Nos. 1,575,217 and 1,708,392

FOR TIN ELECTROPLATING

SALES AGENT

The Electrochemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.

BRASS SHEET
Bronze and Gilding
Processed For Difficult Drawing Bright Finishes
ROD - WIRE
BRISTOL, CONNECTICUT
Offices:
15 Park Row, NEW YORK
Hospital Trust Building, PROVIDENCE, R. I.

INDIAN BRAND
POLISHING ABRASIVE
A new type, long wearing, economical abrasive grain. Perfected and introduced by us as a substitute for imported Turkish Emery. Leading defense plants now using large quantities for essential war-work, report excellent results.
Send for trial lot—Free
HAMILTON
EMERY & CORUNDUM COMPANY
Established 1904
Chester Mass.

For a real good polishing job use
KEYSTONE EMERY
Write for Sample
KEYSTONE EMERY MILLS, 4318 Paul St., Phila., Pa.

MUNNING
A Complete Line of Requirements for the Electroplating Industry
MUNNING & MUNNING, Inc.
Manufacturers of Electroplating, Buffing, Polishing Apparatus and Supplies.
202-208 EMMET ST. NEWARK, N. J.
Branch Offices: New York, Philadelphia, Woonsocket, R. I.

CHROMIUM PLATING
SCREWS—RIVETS—WASHERS
SMALL PARTS, ETC.
THE CHROMIUM PROCESS CO.
Shelton, Conn.

Truly—Three Great Finishes!!
CHROMIUM — UDYLITE — SHERARDIZING
For over a quarter of a century building and installing portable sherardizing furnaces and equipment; metal finishing and plating. We invite your inquiry.
THE NATIONAL SHERARDIZING & MACHINE CO.
Office & Factory Hartford, Conn.
Foreign Representatives—Oliver Bros., Inc.,
417 Canal St., N. Y. City

NICKEL SILVER
Sheets—Rolls
Phosphor Bronze, Bronze Gilding Metal
Low Brass and Special Alloys
WATERBURY ROLLING MILLS, Inc.
Waterbury, Conn.

Supply Prices, March 22, 1943

Anodes

Prices are f.o.b. shipping point on quantities of from 500-999 lbs. for copper, brass and zinc. For nickel, prices are for quantities from 500-2,999 lbs.

COPPER: Cast, elliptical, 15" and longer	25⅛c. per lb.	ZINC: Cast, 99.99, 16" and over	16¼c. per lb.
Electrolytic, full size, 22⅞c; cut to size	22⅞c. per lb.	NICKEL: 95-97 cast, elliptical 46c. per lb., 99% plus	
Rolled, oval, straight 15" and longer 23¼c. per lb.; curved	24¼c. per lb.	cast 47c.; rolled, depolarized	49c. per lb.
BRASS: Cast, 80-20, elliptical, 15" and longer	23⅝c. per lb.	SILVER: Rolled, .999 fine per Troy (1-9) oz.	58c. per oz.

Chemicals

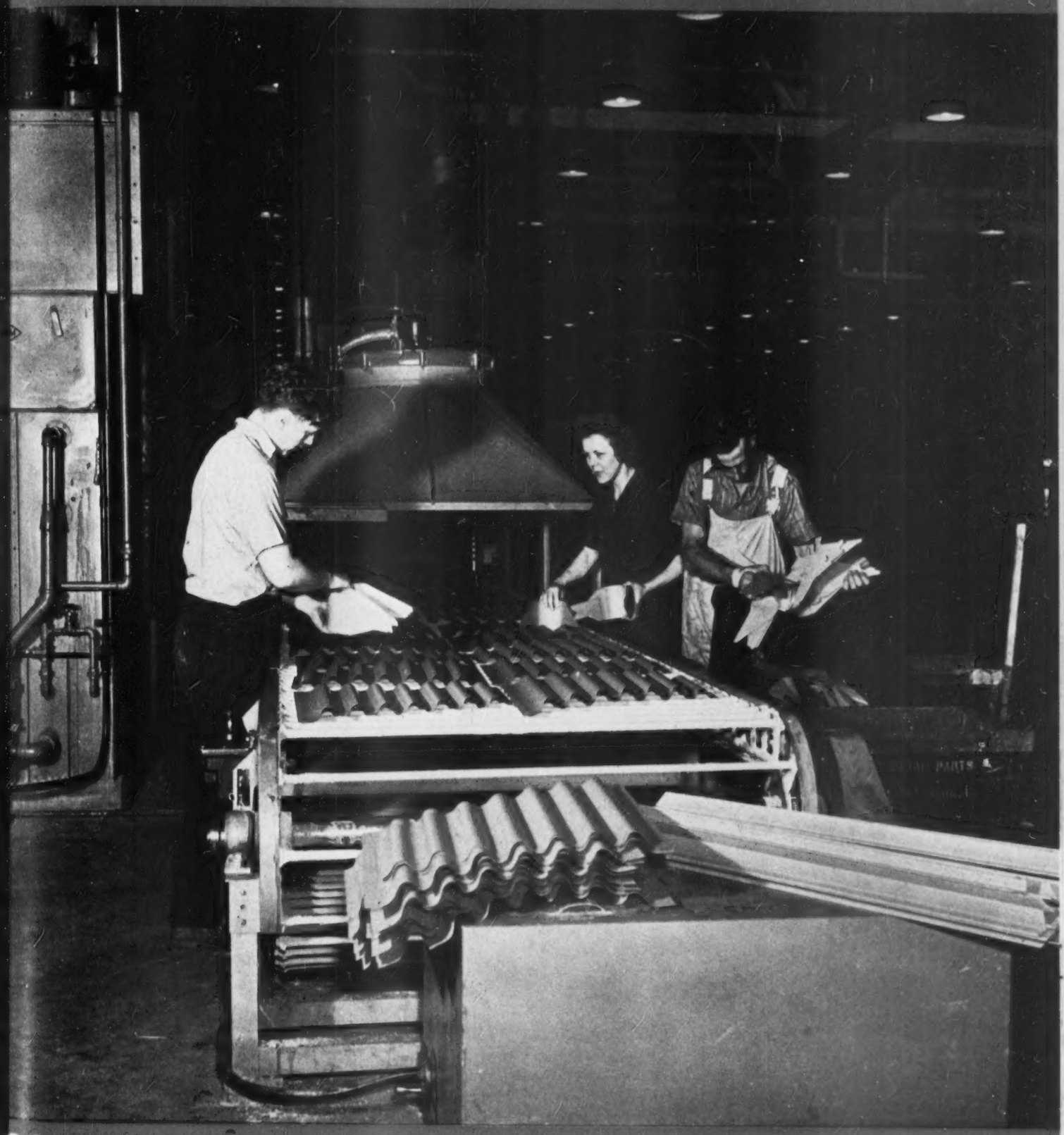
These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P., dms., l.c.l.	lb.	.09
Acid, Acetic, glacial, 99.5%, bbls.	lb.	.0940
Boric, tech., 99.5% gran., bbls.	lb.	.0635
Chromic, 99%, 100 lb. dms., l.c.l.	lb.	.1725-.1825
Hydrochloric (muriatic) tech., 20°, cbys., wks.	lb.	.0175
Hydrochloric (muriatic) C.P., 6 lb. bottles	lb.	.19
Hydrofluoric, 30% wooden bbls.	lb.	.06
Hydrofluoric, 48%, lead cbys.	lb.	.12
Nitric, 36°, cbys. 1-9, wks.	lb.	.0595
Nitric, 42°, cbys c.l., wks.	lb.	.065
Oleic (Red Oil), dms.	lb.	1325-.1425
Oxalic, small quantities	lb.	.125
Phosphoric, 75%, c.l., cbys.	lb.	.0510-.0535
Stearic, double pressed, bags	lb.	.15-.16
single pressed, bags	lb.	.1425-.1525
triple pressed, bags	lb.	.18-.19
Sulfuric, 66°, cbys c.l., wks.	lb.	.015
Alcohol, Amyl (Fusel oil, ref'd), l.c.l.	lb.	.151
Butyl-normal, l.c.l.	lb.	.1225-.1575
Denat., S.D. #1, 190 pf., bbls., c.l., wks.	gal.	.62
Diacetone, tech., dms., l.c.l.	lb.	.115-.14
Methyl, (Methanol), synthetic, dms., l.c.l.	gal.	.37
Propyl-Iso, 99%, dm., l.c.l.	gal.	.47
Propyl-Normal, dms., wks.	gal.	.67-.70
Alum, ammonia, granular, bbls. wks.	lb.	.04
Aluminum Sulfate, iron-free, bgs., c.l., wks.	lb.	.02-.0210
Potash, granular, bbls., wks.	lb.	.0425
Ammonia, aqua, 26°, cbys.,	lb.	.0525
Ammonium, chloride (sal-ammoniac), white granular, bbls., wks.	lb.	.0515
Ammonium, Sulfate, dom. bulk	ton	$29.20
Sulphocyanide (thiocyanate) tech., bbls.	lb.	.17
Antimony Chloride (butter of antimony), sol., cbys..	lb.	.17
Arsenic, White, powd., keg, l.c.l.	lb.	.0475
Barium Carbonate, pptd., bags, l.c.l., wks.	lb.	.03
Benzene (Benzol), 90%, dms., wks.	gal.	.20
Borax, tech., bgs.	ton	$61.00
Butyl Lactate, dms.	lb.	.265
Cadmium Oxide, l.c.l., bbls.	lb.	.95
Calcium Carbonate (Pptd. chalk), c.l., wks.	lb.	.02
Calcium Chloride, flake, paper bgs, 5-ton lots	ton	$28.50-$41.00
Carbon Tetrachloride, l.c.l., 52½ gal. dms.	gal.	.80
Cobalt Sulphate, dms.	lb.	.65
Copper, Acetate (verdigris), bbls.	lb.	.26-.35
Carbonate, 52-54%, bbls.	lb.	.195-.205
Cyanide, tech., 100 lb. bbls.	lb.	.34-.38
Sulphate, 99%, crystals, bbls., 1-5	lb.	.0565
Cream of Tartar (potassium bitartrate), gran., kegs	lb.	.585
Crocus Martis (iron oxide) red, bbls., c.l.	lb.	.09
Dextrin, white, bags, l.c.l., F.O.B. Chicago	lb.	.0415
Dibutyl Phthalate, dms., l.c.l.	lb.	.205-.2120
Diethylene Glycol, dms., l.c.l., wks.	lb.	.155
Emery (Turkish)	lb.	.08
Ethyl Acetate, 85%, l.c.l., dms., wks.	lb.	.122-.125
Ethylene Glycol, l.c.l., dms.	lb.	.165
Monoethyl ether, dms., l.c.l.	lb.	.125-.155
Gold, Chloride, yellow, 4 oz. bottles	oz.	$19.00
Cyanide, potassium 41%, bottles, wks.	oz.	$14.20-$14.95
Cyanide, sodium (46%)	oz.	$17.10
Gum, Arabic, white, powder, bgs.	lb.	.33-.35
Hydrogen Peroxide, 100 vol., cbys.	lb.	.16-.185
Iron Chloride (ferrous), cryst., l.c.l., f.o.b., Midland, Mich.	lb.	.035
Iron Chloride (ferric), cryst., bbls.	lb.	.05-.08
Iron Sulphate (Copperas), cryst., bbls., 1-4 wks.	lb.	.02
Lead, Acetate (Sugar of Lead), cryst., bbls.	lb.	.125
Oxide (Litharge), com., powdered, bbls.	lb.	.09
Lead, White, dry bbls.	lb.	.085
Magnesium Sulphate (Epsom Salts), tech., bbls.	lb.	.019
Mercury Bichloride (Corrosive Sublimate), cryst.	lb.	$2.39
Mercuric Oxide, tech., red, powder, bbls.	lb.	$3.26
Mineral Spirits, tanks	gal.	.10
Naphtha, V. M. & P., tanks	gal.	.11
Nickel, Carbonate, dry, bbls.	lb.	.36-.365
Chloride, bbls.	lb.	.18-.20
Salts, single, 425 lb. bbls.	lb.	.13-.135
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin, refined, 123-125 A.M.P.	lb.	.052
Perchlorethylene, dms., l.c.l.	lb.	.085
Potash, Caustic, 88-92%, flake, wks., c.l.	lb.	.07
Potassium, Bichromate, casks	lb.	.10
Carbonate (potash) calc., wks., dms.	lb.	.065
Cyanide, 94-96%, dom. dms., wks.	lb.	.55
Nitrate, rfd., gran., bbls.	lb.	.086
Permanganate, tech., dms., wks.	lb.	.2075-.22
Phosphate, dibasic, ¼ lb. bottles	lb.	.91
Pumice, ground, 1½ F. & coarser, bbls., wks.	lb.	.045
Quicksilver (Mercury), dom. 76 lb. flasks, net	flask	$191.
Rochelle Salts, crystals, bbls.	lb.	.44
Rosin, gum, D dms., dock	lb.	.0365
Silver, Chloride, dry, 50 oz. lots	oz.	.455
Cyanide, 100 oz. lots	oz.	.41⅛
Nitrate, 100 oz. lots	oz.	.32⅝
Sodium, Acetate, flake, gran., powd., 60%, dms., l.c.l.	lb	.055-.06
Bisulphite, powd., bbls., l.c.l., wks.	lb.	.0350-.0360
Bicarbonate, tech., bbls., l.c.l.	lb.	.0205
Carb. soda ash), light, 58%, bags, l.c.l.	lb.	.0213
Citrate, U.S.P., kegs, 100 lb. lots	lb.	.25
Cyanide, 96%, dom. 100 lb. dms.	lb.	.15
Dichromate, 9 bbls. or less, wks.	lb.	.0775
Hydroxide (caustic soda) 76%, flake, l.c.l.	lb.	0.355-.049
Metasilicate, granular, 1-9 bbls.	lb.	.0355
Nitrate, rfd., gran., bbls., wks.	lb.	.04
Nitrite, 96-98%, dom., bbls., l.c.l.	lb.	.089-.119
Phosphate, dibasic, cryst., bbls., l.c.l., wks.	lb.	.0315-.0365
Orthosilicate, anhyd., 1-2 dms.	lb.	$5.85
Phosphate, tribasic, l.c.l., bbls., wks.	lb.	.0365
Pyrophosphate, anhyd., bags, c.l., wks.	lb.	.0528-.0610
Sesquisilicate, 1-9 bbls.	lb.	.043
Stannate, dms.	lb.	.335-.365
Sulfate, anhyd., bbls., wks.	lb.	.022-.024
Sulphide, cryst., bbls., less than 5 tons	lb.	.0315
Sulfocyanide, dms.	lb.	.55-.65
Thiosulfate, cryst., bgs., wks., c.l.	lb.	.0225
Sulphur, Flowers, U.S.P., bbls., l.c.l. mine	lb.	.0415
Tin Chloride, crystals, bbls.	lb.	.39-.395
Toluene (Toluol), 2°, ind., dms.	gal.	.33
Trichlorethylene, dms., l.c.l.	lb.	.085
Tripoli, air-floated, bgs., c.l., wks.	ton	$21.50
Wax, Bees, yellow, crude	lb.	.4475
Carnauba, refined, bags	lb.	.7675-.80
Montan, bags	lb.	.45-.46
Spermaceti, blocks	lb.	.26-.27
Whiting, chalk, l.c.l.	ton	$20-$24
Xylene (Xylol), ind., returnable dms., wks.	gal.	.32
Zinc, carbonate, tech., bbls.	lb.	.14-.20
Cyanide, 100 lb. kegs	lb.	.33-.37
Chloride, tech., granular, dms., c.l., wks.	lb.	.0575
Dust, bbls., l.c.l., wks.	lb.	.1135
Oxide, lead-free, bbls., l.c.l.	lb.	.0775
Sulphate, crystals, bbls., l.c.l.	lb.	.046

APRIL, 1943

ORGANIC FINISHING

SECTION OF METAL FINISHING



CQUERING • ENAMELING • JAPANNING • PAINTING

Cooperation Plus JOINT ACTION PLUS
TEAMWORK PLUS
Concerted Effort Plus HARMONY PLUS

That's Synergism

There's always been a certain amount of industrial cooperation, team work or whatever it might be called. It's existed between departments, companies, industries and has done a lot of good.

But war has shown us that it has to be vitalized, given a whole new outlook, in a word, synergized. The term synergism may be new to industry but it's an old word. Doctor, chemist, theologian have known it. Derived from two classical Greek words, it means, basically, "forces working together to produce a whole greater than the sum of its parts."

If ever "Synergism"—industrially speaking—was needed, it is in these war days and in the peace that will follow. Unheard-of new conditions, the necessity of new products to overcome shortages, the needs of great masses of people, and other factors demand that we get together individually, departmentally and as companies for synergistic thinking and action. Synergism, so applied, will produce great new ideas that will far exceed the results of both thinking separately. This "plus" value, born of minds that "click" truly makes **2 plus 2 equal 5.**

We at Zapon and Atlas are mighty synergism-minded. In all our fields of chemistry, coated fabrics, finishes, we're putting it to work with real results. Through directed collaboration of minds and companies we can solve many problems, create new products with new values. Let's talk it over.

ZAPON

REG. U. S. PAT. OFF.

ZAPON DIVISION · ATLAS POWDER COMPANY

Eastern Sales: Stamford, Conn. *Western Sales:* North Chicago, Ill.

INDUSTRIAL FINISHES

Section of
METAL FINISHING
Founded January, 1903
as Metal Industry
Publication Office
11 West 42nd St., New York

ORGANIC FINISHING

SECTION OF METAL FINISHING

APRIL, 1943

CONTENTS

Turpentine — By Stanley T. Dingman 245

Flame-Priming Method of Preparing Steel Surfaces for Painting — By E. W. Deck 249

Color-Mixing and Matching —By L. F. Wade 255

Finishing Aluminum Parts For Military Aircraft 257

DEPARTMENTS

This is Washington 244

New Equipment and Supplies 260

Shop Problem 262

Manufacturers' Literature 263

Obituary 263

Automatic Finishing

Perhaps the most critical operation in any high production manufacturing line is the last one. Here, if anywhere, is an ideal place for a bottleneck. If there is a tie-up for any reason, work backs up and often the whole line is forced to suspend operations until the jam is removed. Also, if work is spoiled, it may be ruined beyond repair or at least require valuable time, labor and material to make it right again.

Finishing operations, usually the last, are in this unenviable position. There is naturally much pressure to get the work out quickly and at the same time have it well done. We are tremendously impressed with the speed with which finishing operations are being performed and with the uniformity and quality of finishes being applied in our war plants. The reason, of course, is automatic equipment. Never in the history of the industry have so much automatic spraying, dipping, etc. been done.

Automatic finishing, was well advanced at the time we entered the war. The number of installations was not as large as it might have been but sufficient knowledge had been gained so that the finishing industry was able to assume the burden placed upon it by the demands of a tremendous war production program.

When the war is over and won, automatic equipment will be the means for finishing the great volume of civilian goods which will have to be produced. Much equipment will be available, much experience will have been gained and it will have been thoroughly demonstrated that where volume production, low unit cost, high uniformity and quality are required, automatic finishing is the only answer.

L. H. LANGDON, *Publisher* • T. A. TRUMBOUR, *Business Manager*

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

Army Purchase Information Bulletin The War Department released on March 1, 1943 a new edition of the Army Purchase Information Bulletin. This new edition, which is being distributed by the Army Purchases Division, Headquarters, Services of Supply, is more comprehensive than former editions. In it one finds a complete and detailed outline of the basic methods of army procurement. The bulletin calls special attention to the creation of the Smaller War Plants Branch of the Purchase Division. Small business is invited to avail itself of the counsel and guidance of this new branch.

Chemical Distribution The March, 1943, distribution of chemicals, such as anhydrous ammonia, aqua ammonia, benzene, calcium carbide, castor oil, chlorine, copper chemicals, glycerine, methanol, methylethyl ketone, oiticica oil, protective coatings, C and X types of phthalic alkyd resins, secondary butyl alcohol, shellac, sodium chlorate, synthetic sodium nitrate, tung oil, and vinyl resins, under allocation orders amounted to about $93,000,000 in value. Of that amount $39,000,000, or 42 per cent, was for military purposes. This is at the annual rate of $1,116,000,000 for the total and about $468,000,000 for military purposes only.

Cresylic Acid Price Fixed The OPA established a maximum producers' price of 72.8 cents per gallon for imported grade A cresylic acid, which is used in the production of plastics and resins. Amendment No. 3 to Maximum Price Regulation No. 192, issued on March 18, 1943, recognizes a 2.8 cents per gallon differential between grades A and B, and sets the same ceilings on this chemical as established by British price control.

Drying Oils Face Future Restrictions Members of the WPB Paint, Varnish and Lacquer Industry Advisory Committee were told on February 28, 1943 that because of the increasing needs for drying oils by the armed forces, the allowable amount for civilian protective coatings would have to be reduced. In the near future the quotas in Order M-71 will be readjusted to meet the increased demands of the armed services.

Formaldehyde Under New Regulation Formaldehyde, and its chemical reaction products, used in the production of resins for the manufacture of adhesives, plastics, and protective coatings, came under new regulations in Allocation Order M-25, (formerly General Preference Order M-25) as amended February 20, 1943. No authorization is now necessary for acceptance or delivery of formaldehyde in any form or solution containing 555 pounds or less of formaldehyde in weight.

Linseed Oil Usage Urged WPB Chemicals Division representatives told members of the Insulating Varnished Cambric Industry Advisory Committee that the present rate of production of insulating varnished cambric, which is used largely for wrapping Navy cable, is ample to meet the needs for 1943. The members were also told that the decreasing availability of castor and tung oils necessitated the using of treated linseed oil wherever possible. At this meeting it was suggested that phenols might be replaced by vinyl resins; that the supply of phenol resins is expected to increase in the next 60—90 days, and that the supply of cresylic acid and xylenols was growing tight.

Linseed Oil Price Ceilings As a result of recent discussions held by the Linseed Crushers Industry Advisory Committee of the Food Distribution Administration, Commodity Credit Corporation officials, and representatives of the OPA, ceilings will soon be placed on linseed oil.

Marine Paint Committee Meets The WPB Marine Paint Manufacturers Industry Advisory Committee was recently told by WPB officials that the use of castor, tung and oiticica oils may have to be eliminated in marine paints except in required places of ships. The committee was asked to examine formulae for proprietary paints for the purpose of eliminating the use of hard oils and glycerine. Maleic oils, it appears, will not be obtainable for civilian marine uses during the war.

NWLB's Ruling on Wage Increase Acting within its authority as provided by Section IV, Title II of Executive Order 9250 the National War Labor Board issued General Order 30 on March 16, 1943 which rules that employers are permitted to grant increases without the board's approval, if such increases do not bring the wage or salary rates above 40 cents an hour. Increases of this sort, the board ruled, "shall not furnish a basis either to increase price ceilings of the commodity or services involved or to resist otherwise justified reductions in such price ceilings."

Oiticica Oil Use Urged To conserve the existing supply of tung oil, and to prevent oiticica oil from deteriorating from long storage, the Fats and Oils Branch of the Food Distribution Administration has urged that oiticica oil be used as a substitute. Applications for the substitution should be made on WPB form PD-600.

Order L-221 Form To Be Revised At the March 1, 1943 meeting of the Electric Motor Industry Advisory Committee, the members recommended the scheduling of electric motor production to conform with the recently issued General Scheduling Order M-293. The demand for fans and blowers, pumps and compressors, and machine tools, was discussed. It was brought out at the meeting that form PD-738, which is required by General Conservation Order L-221, will be revised in the near future for simplification purposes.

Order M-71 To Be Amended The necessity for curtailing the use of castor, oiticica and tung oils was stressed at the meeting of the Oleo Resinous and Tower Oil Coating Industry Advisory Committee on March 4, 1943. The committee was informed by representatives of the Protective Coatings and Materials Section of the Chemical Division of the WPB that an amendment to Order M-71 is in the making.

Packaging of Paints Conservation Order M-81, amended on February 18, 1943, permits the packing of casein paste paints and vegetable protein paste paints in fiber-bodied cans.

Paint Container Restriction Postponed The WPB Director General of Operations announced on February 20, 1943 that paint manufacturers are permitted to continue to use indefinitely one gallon fibre-bodied containers with blackplate ends. Conservation Order M-81, as amended December 9, 1943, prohibited the use of such containers after February 15, 1943.

TURPENTINE

By STANLEY T. DINGMAN

Linden, N. J.

This is the second of a series of articles dealing with ingredients of organic finishing materials. Turpentine, an important thinner produced domestically from natural sources, is discussed. It is finding increased use today and the information given here on its manufacture, composition, etc. is especially timely.—Ed.

BUCCANEERS who sailed in search of loot were to some extent, perhaps, responsible for the beginning of the naval stores industry of the United States. As the heat of the southern climes and the pounding of the waves worked the caulking from the seams of their wooden vessels, they were often forced to find their own source of pitch. The pine forests bordering the coasts of what are now the Southern states offered a natural and safe supply to the sea raiders.

Later on ship chandlers, or supply men, in the Atlantic ports found a demand for oakum in the foreign vessels plying their trade with the colonies and in the growing shipbuilding trade of New England. To the other items of rigging and ship fittings were added pine pitch, or pine tar, and products made from it, such as oakum, turpentine, and rosin. These products of the pine forests, which along with all other items in the ship chandler's shop became known as naval stores, found several varied uses on board ship.

For some unaccountable reason although the term "naval stores" has long since ceased to be applied to the items which were once the ship chandler's chief stock in trade, it has continued to be used in reference to the crude oleoresin of the longleaf yellow pine and the slash pine, and to the pine oil, rosin and various types of turpentine made from this pine gum. This usage continues in spite of the fact that such products lost their importance as naval stores when the wooden sailing ship was replaced by the internally driven steam vessel. Today, these naval stores have their greatest use in fields only remotely related to ships and shipbuilding. Paint and varnish, and similar industries, are the most important users of naval stores at present.

Fig. 1—Chipping a streak into a pine tree.

Naval stores properly include two distinct classes of products — those made from the resinous exudate of living trees and those made from the stumps of felled trees. Products in the first group are known as gum naval stores, while those made from tree stumps are called wood naval stores. The rosins and turpentines procured by the various methods exhibit some differences in chemical composition and physical characteristics, but generally speaking, they are interchangeable for industrial use.[1]

Types of Turpentine

Turpentine is classed, according to the Federal Naval Stores Act, into four types depending upon the method by which it is produced. These are as follows[2]:

1. *Gum spirits of turpentine.* This refers to the spirits of turpentine obtained by the distillation of the oleoresin or gum of living trees. Commonly, this type of turpentine is called gum turpentine, gum spirits, spirits of turpentine, or oil of turpentine.
2. *Steam-distilled wood turpentine.* This refers to the spirits of turpentine obtained by steam distillation from the oleoresinous component of wood either in the wood or after the oleoresin has been extracted. Wood turpentine, steam distilled turpentine, and S. D. turpentine are other names sometimes applied to this product.
3. *Destructively distilled wood turpentine.* This refers to the spirits of turpentine prepared from the distillate obtained by the destructive distillation of wood.
4. *Sulfate wood turpentine.* This refers to the type of spirits of turpentine prepared from the condensates recovered in the sulfate process of cooking wood pulp.

While all of these types of turpentine have some value to industry, only the first three are generally reported in the

market quotations of most trade magazines. Of those that are reported, the gum spirits of turpentine commands a premium of about 25 cents a gallon over the destructively distilled wood turpentine, and 10 cents a gallon over steam-distilled wood turpentine.

Turpentines all consist of alpha and beta pinene, dipentene, terpinenes, borneol, fenchyl alcohol, limonene, and traces of camphor. Steam-distilled wood turpentine has about 85% alpha pinene and the remaining portion consists largely of dipentene. Due to this larger amount of dipentene, this type of turpentine has somewhat better wetting and solvent qualities than the gum turpentine, and the predominance of alpha pinene gives it a narrower distillation range. These two products, however, are interchangeable for industrial use. Destructively distilled wood turpentine contains somewhat more impurities, is darker in color, and is a more powerful solvent. When refined, it is used in lower grade paints and varnishes.[3]

One of the reasons why turpentine is an excellent ingredient of paints and varnishes is that it has such good wetting and penetrating properties. Another important action of turpentine as far as paint and varnish are concerned is its ability to carry oxygen into and through the film. The oils in the coating are then thoroughly dried and cured throughout, not just on the surface. Consequently, the film is likely to be more permanent. Evidently the petroleum fractions such as mineral spirits do not have this ability to act as oxygen carriers.[4]

Manufacture

Gum naval stores production is somewhat reminiscent of the making of maple syrup in the sugar bush of New England. But, instead of being limited to a few weeks in the spring of the year when warm days and cold nights stimulate the flow of maple sap, the gathering of the raw materials for naval stores is a year-round industry. Often the raw pine gum is distilled in crude stills in rough shacks (see Figure 2), but more frequently, the work is done in modern industrial plants which turn out fresh, clean products in large quantities. One of these modern plants is shown in Figure 3.

Crude pine gum is gathered from April to October. About once a week a V-shaped cut, known as a streak, is made on the trunk of each tree. Each streak is made directly above the previous cut and the combined streaks form what is known as a face. Approximately 32 streaks are cut into each tree during the gum-flowing season. A group of 10,000 faces is considered as a "crop," which is the working unit of the industry.

Fig. 2—Gum naval stores plant fire still.

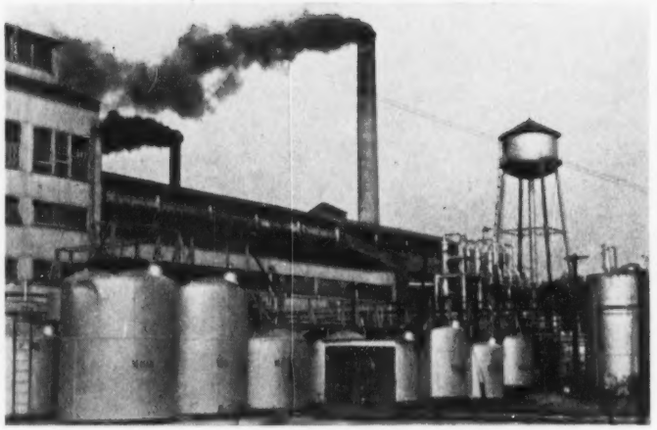


Fig. 3—Modern naval stores plant.

The streaks are cut well through the inner bark so as to sever the resin ducts. The clear oleoresin which bleeds from the fresh cut flows down over the face. A metal apron, or gutter, fastened at the bottom of the face directs the flow of the resin into the cup, which is the name given to the collecting receptacle. About once a month the cups, which usually have a capacity of about three pints, are emptied and the gum taken to the still. Figure 1 shows how the streak is cut into the tree.

Distillation of gum turpentine is a comparatively simple operation. The crude gum is loaded into copper pot stills without any preliminary cleaning. A small amount of water is added and then the still is heated by a direct wood fire. Turpentine and water vapors are driven from the gum by the heat and they are then condensed in the copper coil. From here the two liquids flow into a separator. As the two are practically insoluble in each other, they automatically separate into two distinct layers, with the turpentine on top. Automatic devices permit the continual drawing off of turpentine from the top of the separator, while the water is drawn off at the bottom. Sometimes the turpentine is run through a dehydrator which contains rock salt that absorbs any small amount of water which might be present in the turpentine.

Wood Turpentine

Wood naval stores, instead of being made directly from the resin gathered from living pine trees, are made from pine stumps, fallen branches and trimmings of trees that have been logged. As was mentioned before, turpentine, rosin, and other products can be extracted either by steam distillation, by destructive distillation, or by the sulfate process.

In the steam distillation process, the wood is ground up and put into a heated still. Live steam is forced into the still. The volatile components are freed by the heat and carried into the condensing coil by the steam. Later on, this condensate is fractionally distilled to yield steam-distilled wood turpentine and pine oil. The ground wood left in the still is treated with a petroleum solvent which dissolves the rosin and the liquid products not taken out by steam distillation. After clarifying this solution to remove foreign matter, the solvent is evaporated, leaving a residue of wood rosin.

To produce wood naval stores by destructive distillation, stumps and branches are charged into a retort in steel cars. The retorts are sealed to exclude air and then are heated. Volatile components of the wood are driven off by the heat and then condensed. This process produces turpentine, tars, tar oils, rosin and charcoal.

Sulfate wood turpentine is recovered as a by-product of the sulfate process of producing paper pulp from pine wood. Vapors released from the pulping digesters are condensed and then chemically treated and fractionally distilled to get rid of the sulfur compounds which are present in large quantities. From the spent cooking liquor used in this method of making paper pulp, a mixture of fatty and resin acids, known as talleol or liquid rosin, is recovered.

Turpentine is generally sold not by grade but under the name of the process by which it was produced. To be of best quality, it should be clear and water-white and should have the following characteristics[5]:

Specific gravity at 20° C.	0.8617 to 0.8889
Refractive index	1.4684 to 1.4818
Boiling point	154° C. to 159° C.

Although the figures given here are for gum spirits of turpentine, those for steam-distilled or destructively distilled turpentine do not differ greatly. The following are data on two commercially available steam-distilled turpentines:

	I	II
Specific gravity	.860 to .866	.860 to .865
Refractive index	1.465 to 1.469	1.465 to 1.470
Unpolymerized residue	2%	2%
Boiling point	150° C. to 160° C.	150° C. to 160° C.
Distilling below 170° C.	94%	95%

Uses

As has been mentioned before, naval stores are used for a wide range of products and processes. Turpentine, in addition to being used as a solvent and thinner in paints, varnishes, and lacquers, goes into the production of synthetic camphor, and in soaps, polishes, and pharmaceuticals. Terpin hydrate, an ingredient of some treatments for whooping cough, is made from turpentine.[6]

Turpentine, to repeat, is valuable as a paint and varnish thinner because of its penetrating action that permits the film to become more thoroughly bonded to the surface on which it has been applied. Several substitutes for turpentine have been developed and sold. Many of them are, of course, excellent products and undoubtedly have economy of price or other individual properties to recommend them. Often, however, these are products derived from petroleum and today may be difficult to obtain because of priorities, rationing, and allocations. Benzol (benzene), which is produced from coal, and its derivatives, as well as benzin (petroleum ether), have been declared by the WPB as products for which substitutes should be used (Feb. 1, 1943). Turpentine, on the other hand, is not subject to any restrictions on price, production, or use at the present time. Efforts by the government, however, are being made to build up a stock-pile of turpentine and rosin for various war and Lend-Lease needs. Whether this, coupled with an impending shortage of labor[7] is likely to result in a shortening of the supply cannot be foreseen, but present indications are that turpentine will continue to be readily available.

References

1. Mellan, Ibert. *Industrial Solvents.* p. 133. Reinhold Publishing Co., New York, (1939).
2. U. S. Dept. of Agric. Misc. Pub. 476. *Production of Naval Stores.* Washington, D. C., (1942).
3. Mellan, Ibert. *Industrial Solvents.* pp. 137-8. Reinhold Publishing Co., New York, (1939).
4. Sabin, A. H. *Technology of Paint and Varnish.* p. 82. John Wiley & Sons, New York, (1904).
5. U. S. Dept. of Agric. Bulletin 144. p. 22. Washington, D. C., (1911).
6. U. S. Dept. of Agric., Misc. Pub. 476, *Production of Naval Stores.*
7. Oil, Paint & Drug Reporter. **143**, No. 2, pp. 85-86. Jan. 11, 1943.

(Illustrations have been furnished through the courtesy of Naval Stores Research Division, Bureau of Agricultural Chemistry and Engineering, United States Department of Agriculture.)

CUT DOWN REJECTS WITH

ORVUS

IN YOUR METAL CLEANING BATHS

This sulfated fatty alcohol Cleansing Agent is EFFECTIVE

—as a surface tension lowering agent

—as an emulsifier

—in dispersing lime soaps which might cause poor plating results if permitted to deposit on the metal

Write for further information about Orvus to

PROCTER & GAMBLE, Cincinnati, Ohio

The Buy-Word Is "Enthone" for ENAMEL STRIPPERS

For the past 4 years Enthone strippers have been used by hundreds of manufacturers for quickly removing organic finishes from civilian goods.

And NOW—fast working, patented* Enthone strippers are helping to speed the flow of war goods.

Here's what Enthone strippers do:

★ Strip synthetics, japans, lacquers rapidly.

★ Leave all metals clean and bright.

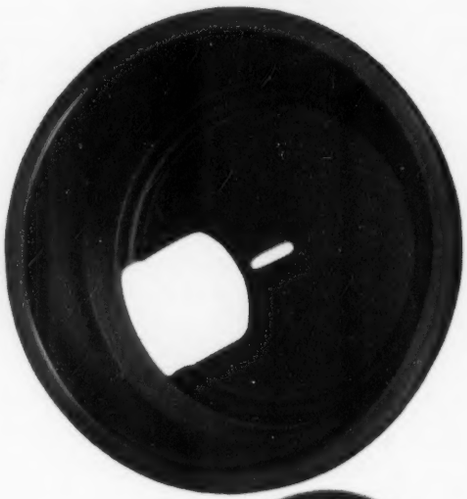
SPECIAL STRIPPERS for SPECIAL PROBLEMS — TELL US YOUR PROBLEM!

THE Enthone CO.

*Protected by U.S Patent No 2242106 NEW HAVEN, CONN.

LET'S GET TOUGH!

EGYPTIAN SPECIAL CLEAR LACQUER is Meeting With Unqualified Success On All Fronts



Over Black Oxide coated articles such as machine gun parts, buckles, gas mask fittings, etc., this newly formulated EGYPTIAN finish provides full protection against:

Corrosion from salt spray.

Staining and spotting in handling.

Cleaner and far more lasting than the use of oil on the assembly line.

Many war contracts require such a finish.

Easy and economical to apply.

Details on Request. Send for the 1943 edition of our important book "U. S. Government Specification Finishes." Ask for "Spec" Book MF

EGYPTIAN FINISHES

THE EGYPTIAN LACQUER MANUFACTURING CO.
ROCKEFELLER CENTER, NEW YORK, N. Y.

EGYPTIAN Superior FINISHES

Flame-Priming Method of Preparing Steel Surfaces for Painting

By E. W. DECK

Development Engineer, Linde Air Products Co.

The previous portion of this article described flame-priming as a process consisting of "scrubbing" steel surfaces with a series of high velocity, high temperature flames with the result that all loose mill scale is removed by sudden thermal expansion and rust is dehydrated and replaced by stable oxides. In addition, all contaminants, such as oil, are consumed and the steel surfaces are left clean and warm, ready for painting after merely wiping free of loosened foreign materials. The following article concludes the discussion.

SURFACES which have been exposed to the corrosive effect of acid atmospheres usually have, in addition to a rust deposit described in the previous article, a mixture of acid salts which, being hygroscopic, tend to pick up and hold moisture. These salts cannot be removed completely by wire-brushing alone, no matter how thorough. By flame-priming, however, moisture is driven out of the salts, forming anhydrous, granulated salts which can be brushed away, leaving a clean surface ideally prepared to receive the protective coating.

Heat Transfer

When the flame-priming head is passed over a steel surface, a superficial layer of the metal is momentarily raised to an extremely high temperature because of the high rate of heat transfer from the flames to the plate. After the flames have passed on, this small amount of heat in the thin, high-temperature zone is given up to the base metal. If the surface is coated with a layer of scale that has a low heat conductivity, the instantaneous surface temperature is comparatively high, since heat is conveyed into the base metal slowly. However, if the metal surface is relatively free of scale, the rate of heat transfer is high, and the maximum temperature reached on the surface is lower. It can be reasoned from this that where rust and mill scale exist, their low thermal conductivity will effect high superficial temperatures which will produce the desired dehydrating action.

The base metal temperature resulting from flame-priming likewise is affected by the thickness of the steel being treated. The final temperatures of the relatively thin plate will, of course, be high when compared with the temperature of a thicker plate subjected to identical treatment. Then too, some structures are flame-primed on both sides while others are flame-primed on one surface only. Consequently, because of these variations, it is impossible to set the exact temperature of steel surfaces after flame-priming, although in most instances it is in the neighborhood of from 125 to 150° F.

These operators are flame-priming, sweeping, and painting part of an order for 4000 tons of structural steel members used in the construction of an overhead parkway system.

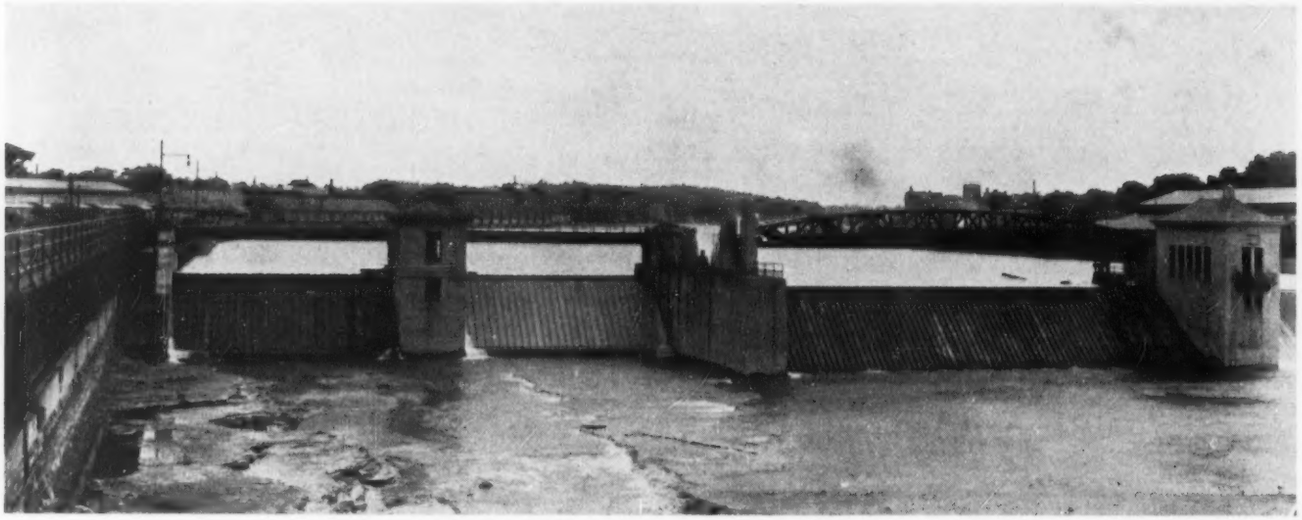
Effect of Heat on Coatings

When paint is applied on a warm surface, its corrosion resistance is increased. The removal of contaminants makes it possible for the vehicle to reach the steel surface where the polar attraction forces can exert themselves to produce a greatly increased bonding strength. It is this property which arrests corrosion-creeping. The heat increases mobility and hastens the evaporation of solvents. The highest temperature being at the metal interface, the solvents do not tend to be trapped by any skin formation and consequently voids and blisters are less frequent. The rate of setting is speeded up by an increase in polymerization of the vehicle caused by the baking action of the heat. This produces a tougher and more lasting film[13] as well as makes possible a desirable reduction in drier content.

Flame-priming and painting should therefore proceed as a continuous operation. The operator handling the flame-priming blow-pipe should be followed immediately by the helper sweeping down the surface, who in turn is followed by the painter.

Also under the subject of heat effects, comes the question of the possibility of distortion resulting from flame-priming. When the process is conducted in accordance with recommended procedures, distortion may be dismissed as a problem because, although temperatures are high, the quantity of heat actually induced into the base metal is low (because of the speed with which the flames are passed

(Reprinted with permission from The Iron Age, October 29, 1942)



Spillways such as the ones in this large dam are another of the important applications of flame-priming. The process was applied after the fabrication had been completed.

over the surface). It has actually been shown that the deflection in a structural member that has been flame-primed is less than that produced by radiant heat from the sun which causes a continuous temperature differential between the exposed and shaded sides.

Evaluation Tests

Flame-priming shows up consistently well in exposure tests. Some authorities feel that the general value of panel tests, as indications of corrosion resistance, is open to question because conditions established in the tests do not always accurately exemplify all conditions. Consistent results in many tests overcome these objections. Numerous tests have been run in the past, conducted by users of flame-priming under their own conditions and with their own materials, with results uniformly favorable to flame-priming. Detailed reports of these tests are not generally available. In a few cases authoritative tests have been conducted.

One series of tests, however, reported by the American Institute of Steel Construction, appears to be representative, authoritative, and conclusive. These tests were conducted by one of the large steel fabricators working in conjunction with a large and reputable paint laboratory. With the knowledge and facilities of both groups, a series of thorough tests was planned and executed in which flame-priming was compared with other processes in general use. The scope and execution of the program included the testing of three common methods of surface preparation—flame-priming, sandblasting, and hand-brushing — with variations of each. Three grades of primers were used: iron oxide and linseed oil, red lead and linseed oil, and a premium-grade proprietary brand of primer. Moderate-sized structural shapes were used as specimens and were exposed in an inland industrial area and in a salt-air atmosphere on board ship. The exposure period for a single coat was one year.

The three methods of surface preparation used included "the best sandblasting practice that could be obtained in connection with heavy fabrication, such as bridge girders," flame-priming in accordance with the specifications of the American Institute of Steel Construction, and hand-cleaning in accordance with the best practice followed by reputable operators working under the usual inspection conditions. Both new and weathered steels were used. Thus, in one group of specimens, the mill scale was intact and free of moisture, while in the other, large portions of scale had rusted off and exposed areas were rust coated.

As expected, the new steel, fresh from the mill and painted immediately with the scale intact and free of moisture, stood up well in service because of the added protection provided by the mill scale. Since steel in this condition is seldom, if ever, available to fabricators, the results are of only academic importance. They show that the intact mill scale affords protection if dry. If it has been exposed, the best method to artificially simulate the desired surface condition is to flame-prime and paint it as soon as possible. This conclusion is confirmed by Tice[11] in a similar set of tests.

As for the question of sandblasting versus flame-priming, it is quite apparent that the flame-primed specimens stood up well by comparison, even when painted with less expensive iron oxide, non-inhibitive paint. In fact, these flame-primed specimens stood up better than the more expensive types of paint on sandblasted specimens. This verifies the claim that special paints are not required for use with the process.

It is particularly notable that at the end of one year the red lead and linseed oil specimens on flame-primed new steel were in perfect condition. The tests also indicated that there is a latitude in the rates of speed used in flame-priming, which will achieve acceptable results. This indicates that recommended practices are more thorough than is actually required.

Among conclusions drawn from this series of tests was the report that "flame-cleaning conducted under the Institute's tentative specification and with considerable latitude in the rate of passage of the flame can give very satisfactory results — results superior in fact to those obtained by sandblasting if the latter is what was employed in these tests."[12]

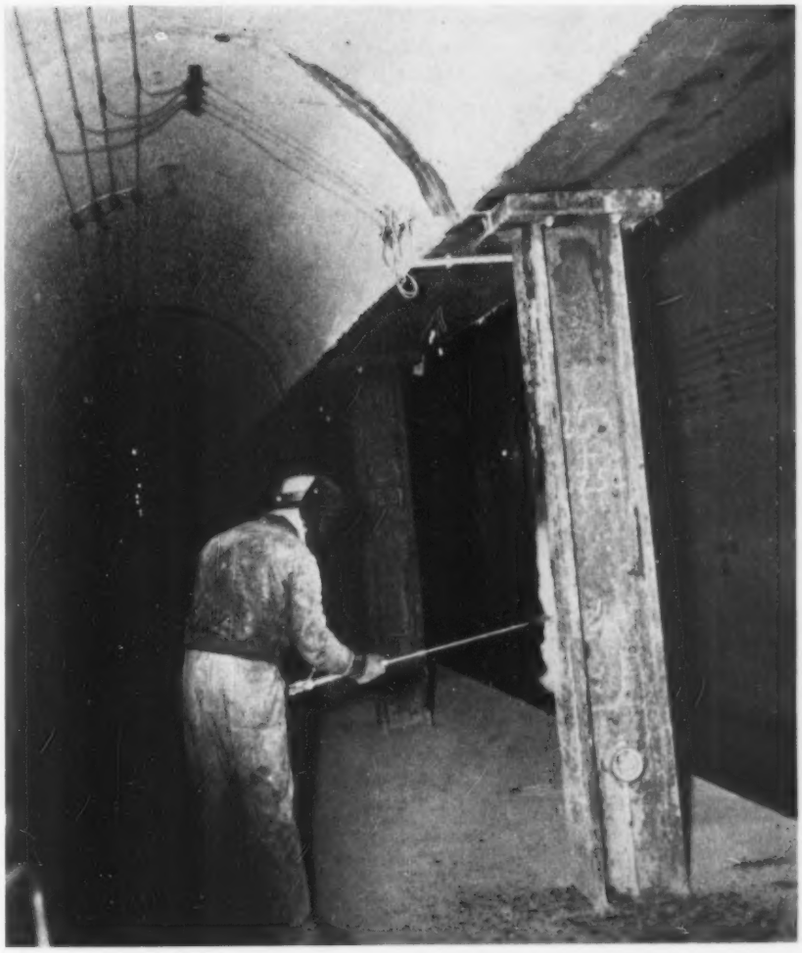
Flame-Priming Operating Data

Visual evidence of the reaction of the steel surface under the priming flames is the real index of the correct speed for blowpipe travel. When rust is present, the formation of black magnetite indicates that the rust has been dehydrated satisfactorily. When

the reaction is carried one step farther and silvery streaks appear in the black magnetite, this is an indication that the flame-priming is even more thorough than is really necessary. When the problem is merely one of removing loose scale, the desired reaction is readily visible in the "popping off" of the scale.

For the purpose of estimating the time it would take to do a certain job, estimates of speed can be made. The rates of travel for the blowpipe vary depending upon surface conditions and the type of structure. For example, speeds as high as 50 feet per minute have been obtained on relatively new I-beams. However, for estimating purposes it is recommended that the conservative figure of about 35 feet per minute be used. When flame-priming is being applied to thick plates that are heavily scaled, this speed might have to be reduced to about 15 feet per minute. Very wet surfaces must be treated more slowly than those having dry rust on them.

A 6-inch flame-priming head used about 137 cubic feet of oxygen per hour, when operated according to recommendations. If the basic speed of 35 feet per minute is attained, the head will treat 1035 feet per hour and will use 13 cubic feet each of oxygen and acetylene for every 100 square feet of surface. On riveted areas, the speed would be about half.



Flame-priming is practically indispensable for preparing structural steel members in subways where they must be painted after erection in a damp atmosphere. This is a view of operations during construction of the new Chicago subway.

Applications of Flame-Priming

Practically any metal surface which is to be painted can profitably be flame-primed so as to improve the quality, corrosion resistance, and life of the paint coat. The process is being used to an ever-increasing extent for this purpose, for such important applications as structural steelwork, storage tanks, dams, locks, piling, railroad cars, combat tank hulls, bombs, shells, ship hulls and deck plates, steelwork in subway construction, plane hangars, and pipe lines.

The process received its first wide acceptance in the structural steel industry. Many important bridge structures have been prepared for protective painting by this method, among them, the new International Rainbow Bridge at Niagara Falls. Other important projects of a similar nature include structural steel work of overhead parkways and of dam spillways.

Another example of the efficient work being done with flame-priming is the new Chicago subway system under construction. Here the advantages of flame-priming are most pronounced because the structures are virtually dripping with wet rust which has formed in the damp compressed air atmosphere during erection. It is not practical to prime this steelwork prior to erection because of marring in handling through the air locks. The portability of the flame-priming equipment solves the difficulty of cleaning after erection.

Flame-priming also is seeing widespread use in connection with the painting of storage tanks, gas holders, and similar structures. These usually are flame-primed after being assembled and tested. There are, of course, certain exceptions to this practice, such as gas holders of the floating-bell type, in which it is not practical to clean between the bell and the shell after erection. Work of this type is flame-primed at the shop prior to shipment, leaving unpainted a narrow zone on either side of the weld area, to be finished after leak testing.

In the past, storage tanks were often allowed to weather in the open after erection and before painting to remove the mill scale. For superior corrosion resistance, such tanks are now being flame-primed immediately after erection to preserve as much as possible of the tight scale, the operation taking place, of course, before the tank is filled with flammable contents. This eliminates the unsightly weathering period, permits the entire job to be accomplished quickly at the time of erection, and improves the corrosion resistance as shown by tests and discussed previously.[11]

Some storage tanks which are to be located underground may be more economically flame-primed and painted before shipment from the fabricating shop. In this connection, it is interesting to note how the simplicity and portability of the flame-priming equipment solved a production prob-

lem for one fabricator of such tanks. Because of increased production, space inside the shop was at a premium. The simplicity of the equipment and materials needed for flame-priming made possible an unusually efficient setup in the crane yard, adjacent to a railroad siding where the operators had considerable freedom and where handling facilities were ideal. Under such conditions, workmanship was naturally of a high quality.

Pressure vessels likewise may be flame-primed and painted prior to shipment or after installation. In view of the likelihood of the prime coat being marred in shipment, however, it is usually desirable to perform the flame-priming on location. To avoid rusting taking place in transit, it sometimes proves advisable to coat the surface with an inexpensive lacquer to act as a temporary protection and preserve mill scale. This is burned away in the flame-priming operation. In instances where it is preferred to have the prime coat applied at the fabricators, it is advisable to include "rigger's eyes" in the vessel design so that the work can be handled without damaging the paint during shipment and installation.

Another timely application of flame-priming is its use in connection with airplane hangar doors. Flame-priming and painting are carried out at top speed and offer lasting protection and efficient operation in the absence of corrosion. Specifications of the U. S. Navy Bureau of Yards and Docks require the process on underground and waterfront equipment and structures, such as piling, storage tanks, and pipe lines. Flame-priming is ideally suited to this type of work because of its portability which speeds construction under all-weather conditions. During flame-priming even those surfaces that are normally wet from salt spray and high humidity are rendered dry, and remain so until painting. After the piling has been driven, scar marks caused by the driving operation are touched up at low tide by flame-priming and coating.

The U. S. Navy Bureau of Ships has issued specifications for flame-priming steel for ship hulls. Hull plates are treated on arrival at the yard and stored in the painted condition. The weld zones can be painted while still warm from welding or they may be flame-primed just prior to painting.

The process also finds increasing application in the reconditioning of previously painted surfaces that have become badly corroded and pitted, particularly industrial structures subjected to highly corrosive conditions. The action of the flames pops the heavy rust loose even in deep pits and drives off any chemical salts, acids or gases that may be clinging to the surface. Materials, such as pipe that has been underground, are freed of mud and moisture simultaneously.

Boats and barges likewise are flame-primed before repainting. Recently a barge that had been exposed to acid water was docked for maintenance painting. The management of a boat yard, quick to realize the need for removing all traces of acids salts before painting, recommended flame-priming and was awarded the reconditioning project. The bottom of the hull was flame-primed and painted in drydock, and the remainder of the hull completed after the barge had been floated again. The process is now used on practically all work at this yard.

References

(11) E. A. Tice, Tests Show Effectiveness of Flame Cleaning Structural Steel, *Steel*, Feb. 9, 1942.

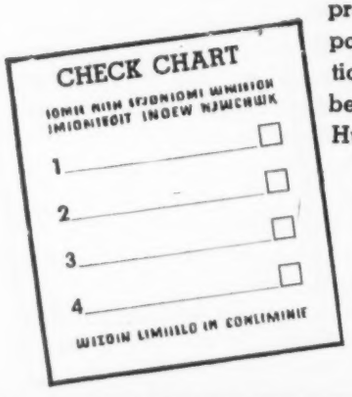
(12) American Institute of Steel Construction, The Preparation of Structural Steel Surfaces for Painting.

(13) E. F. Bennett, A review of Driers and Drying, p. 10.

There's NO "CURE ALL" for Your Cleaning Jobs

EVERY cleaning job presents different problems. Type of metal is important. A good cleaning agent for iron may be ruinous to aluminum. Is the part to be plated, or must a protective coating be retained? What specific elements must be removed? What type of cleaning equipment is to be used? These are typical of the questions that must be answered in arriving at the correct cleaning formula.

Many Hunnewell customers have been surprised at the savings in costs and increased production per man-hour gained through the use of a preparation and procedure specially engineered to their particular cleaning job. Three generations of experience and "know-how" are behind the recommendations made by Hunnewell Cleaning Specialists.



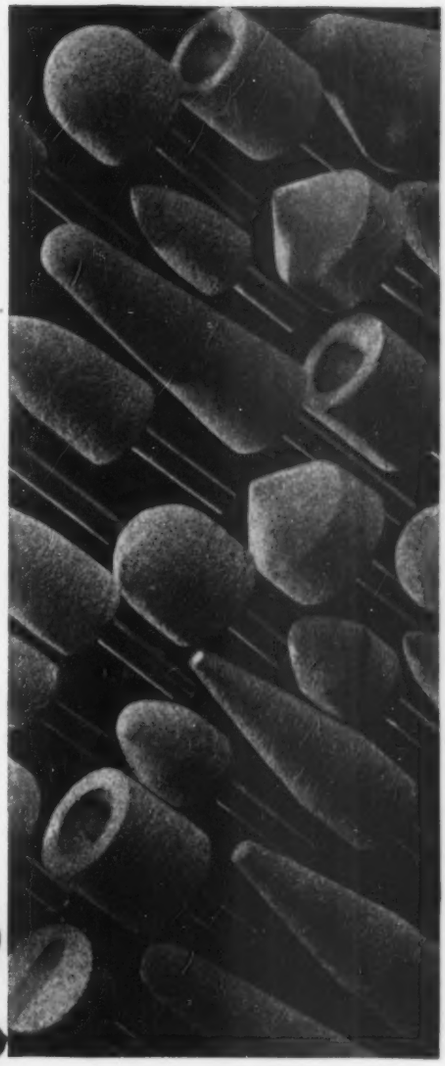
Send for FREE Check Chart

Write us about your metal cleaning problem, or ask for our free Check Chart for easy outlining of your requirements. There is no obligation.

HUNNEWELL SOAP CO.
116 W. SECOND ST., CINCINNATI, O.
OVER 100 YEARS OF SERVICE TO INDUSTRY

SAY! YOU, UP THERE on the PRODUCTION FRONTS

No more holding up the steady flow of vital war needs because you're waiting for grinding wheels.

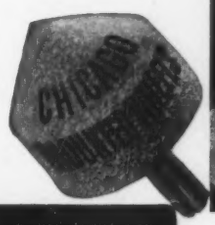


WE'RE RIGHT BEHIND YOU

Can make prompt deliveries on all Mounted Points and Grinding Wheels 3″ in diameter and under. We've stopped making the larger sizes for the duration, so we can fill orders quickly for these important smaller sizes.

TRY ONE FREE

Tell us the kind of job, type grinder you use and size wheel you'd like for your test, and we'll send one free postpaid.



CHICAGO WHEEL & MFG. CO.

America's Headquarters for Mounted Wheels

1101 W. Monroe St., Dept. ML, Chicago, Ill.

IT'S OUR WARTIME JOB!

With the approval and endorsement of W P B, all our facilities are concentrated on turning out large quantities of wheels 3″ in diameter and under. We're at it 24 hours a day, and keeping up with orders. Our central location is an advantage and means no time is lost between our production line and yours.

NEW CATALOG — shows mounted wheels in actual colors and sizes, portable electric tools and time-saving accessories for grinding, burring and polishing.

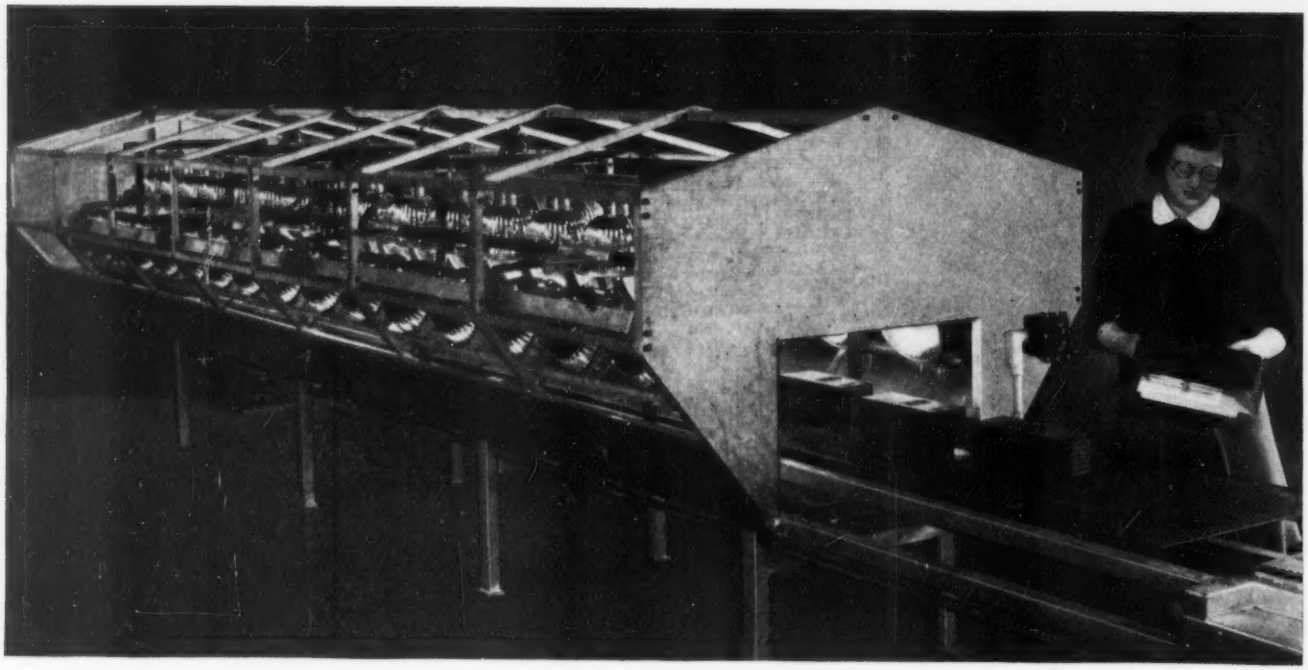
MAIL THIS COUPON TODAY

ML-4

☐ Send Catalog ☐ Free Wheel. Size.....

Name .....

Address .....



IN THE DRYING AND BAKING OF FINISHES

What MEANS MOST *to you?*

- **Conserving manpower?**
- **Increasing production?**
- **Saving space?**
- **Reducing spoilage?**
- **Conserving fuel?**

On all these five counts — and others — a Gifford-Wood Infra-Red System could score heavily in your favor. Consider a typical installation:

Number of employees halved, baking speeded from 45 minutes to 10¼, cooling time shrunk 10%, fuel cost reduced 33%. On top of all that, important savings were made in costs of paint, insurance and maintenance.

Gifford-Wood is ready to design, produce and install a complete Infra-Red System for you including conveyors and all details—under a performance guarantee. If you are still oven-drying and baking finishes, step ahead with Infra-Red. Gifford-Wood can show you how. As a first step, write for Bulletin 0-150.

GIFFORD-WOOD CO.

FOUNDED 1814

New York: Graybar Building **HUDSON, N. Y.** **Chicago: 565 W. Washington Street**

HEADQUARTERS FOR INFRA-RED BAKING AND DRYING

3666

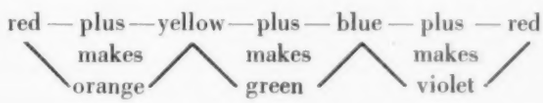
Color—Mixing and Matching

By L. F. WADE

An understanding of the principles of color mixing and matching is essential in the finishing industry. This article discusses color fundamentals and the mxing and matching of color as applied to organic finishing materials.—Ed.

FOR ordinary purposes colors are classified in two groups, namely, primary and secondary. The primary colors are red, yellow and blue. By mixing these primary colors with one another, the secondary colors—orange, green and violet—are obtained.

The rainbow is composed of red, orange, yellow, green, blue and violet so shaded that they blend very gradually into each other. The secondary colors, orange, green and violet lie between the primary colors, red, yellow and blue as follows:



Red, passing to the next primary color, yellow, goes through orange. Red plus yellow equals orange.

Yellow, passing to the next primary color, blue, goes through green. Yellow plus blue equals green.

Blue, the next primary color, passing back to red goes through violet. Blue plus red equals violet.

The finisher should acquaint himself with the peculiarities of the primary colors in order to know how to choose them for specific purposes. For instance, to obtain a pure green by mixing blue and yellow the blue must be inclined toward green and the yellow must be inclined toward green. In other words, both the blue and the yellow must have a green undertone. Should either of these colors be inclined in the opposite direction, the effect would be similar to adding gray and the brilliance would be lost. Similarly, in choosing the colors for making a rich purple, the red must be inclined toward blue and the blue must have a reddish hue.

By toning of color is meant subduing it by the addition of another color, preferably one that is complementary* to it. Thus, yellow may be toned down by adding purple, red by adding green, blue by adding orange. The continuous addition of a complementary color will eventually produce gray.

On the other hand, brightening a color emphasizes the shade. Thus, the addition of white does not brighten a color but merely dilutes it, producing a tint or pastel shade. Yellow will impart brightness to any mixture to which it is added. Warmth of color is obtained by the use of red, while both warmth and brightness are obtained by the use of orange which is a mixture of red and yellow. Green is regarded as a cold color but some of the lighter shades may be used to obtain brightness.

Color Mixing

The finisher must know the characteristics of the colors or pigments which he is blending. For example, many finishers call for Prussian Blue merely because the name has a familiar sound. Prussian Blue has a decided red undertone or in other words, when diluted with white gives a blue with a decided red cast. If the finisher is trying to make a clean bright green he will find it impossible to produce such a color with Prussian Blue because of the red undertone, since red tends to muddy green. As stated above, the proper colors to combine to produce a clear bright green would be a blue which has a green undertone and a yellow which also has a green undertone.

The undertone of a color is not discernible in the color itself but will show up when the color is diluted with white or another color. In order to see true undertone it is often necessary to compare two similar colors. For example, if Prussian Blue and Chinese Blue are diluted with white and compared, the former will show a red undertone and the latter a green undertone.

Top tone is the predominating tone discernible when the color is applied in a heavy film. For example, a purplish-blue might be described as a blue with a reddish top tone. Similarly, a reddish-brown might be described as a brown with a red top tone.

It should be easy to understand the importance of knowing intimately the characteristics of the colors or pigments which are being used and their behavior when mixed or diluted with other colors.

The following describe the characteristics of some of the more important colors used in making finishing materials.

Blues

Blues will show either a red or green cast. Purple blues are of a red cast. For making red blues, start with Prussian Blue as this is a red blue. For making green blues, start with Chinese Blue as this is a green blue. For making a purple blue, start with ultramarine blue.

* Complementary is used in the sense of contrast. Therefore, a complementary color of any given color is the one showing the greatest contrast. For example, red is the complementary color of green, violet of yellow, and orange of blue.

Black will darken and muddy blues. The addition of either iron oxide red, orange, or brown will tend to muddy shades of blue.

Browns

Browns may tend toward yellow, red, or green casts.

Many browns are closely allied to certain grays and it is frequently difficult to distinguish between such shades as to whether they are really brown or gray.

Diluting browns with white will produce tan or fawn shades. Browns containing large quantities of white generally approach gray in shade.

Creams

Under this heading might be listed ivories and buffs and weak yellow and orange shades.

Most ivories are made by adding yellow, and either black, raw sienna or burnt umber to white in varying proportions.

Black will tend to darken creams and it should be borne in mind that where black is added to yellow a greenish cast will result.

Grays

Grays may be of a pure gray shade or may show a red, blue, green or brownish cast. They usually contain large percentages of white to which is added black, with other colors added, to give the required cast or top tone.

Grays showing a brownish cast are generally classified as browns.

It is always advisable to start a gray by combining black and white, adding the necessary additional colors last in small quantities to produce the required top tones.

Greens

Greens will show either a blue or yellow cast. They are made by combining blue and yellow. Olive greens may be obtained by combining yellow and black. Some olive greens require a small amount of orange.

White will weaken, black will darken and both will tend to muddy greens.

Muddy greens diluted with large quantities of white border on gray and some grays may be mistaken for greens and vice versa.

Maroons

Maroons will show either purple, yellow or brown casts.

Maroons, always somewhat difficult shades to handle, are perhaps best considered to be those shades lying between deep red and deep purple. Generally speaking, the deeper the shade of maroon, the closer it is to purple and blue, and the lighter shades of maroon are closer to reds and yellows. From this it might be assumed that maroons could be made by combining reds and blues. Such is by no means the case. In actual practice a mixture of red and blue results in a more or less dirty brown.

Reds

The bright reds or vermilions will show either a yellow or blue cast.

Black is used to darken and muddy reds. White added to red in small amounts tends to bring out whatever blue there is in the red. Large amounts of white weakens the color. Reds and maroons diluted with large quantities of white resulting in weak colors (tints) may be unsatisfactory for certain types of work as such weak shades fade very rapidly, for example, rose, pink, mauve, heliotrope, etc.

Metallic Colors

Metallic finishes are extremely difficult to match accurately due to the many variables involved. Best results are obtained with the more transparent pigments such as dark greens, blues and blacks. In shades containing large percentages of white, much if not all of the metallic effect will be lost.

Color Matching

Color matching is an art and much practice is necessary to become proficient. For obvious reasons specific directions cannot be given for matching colors. However, there are general rules which must be followed if any attempt to match colors is to be successful. They are as follows:

All colors must be stirred thoroughly.

Because colors change shade on drying, don't match a wet color to a dry color or vice versa.

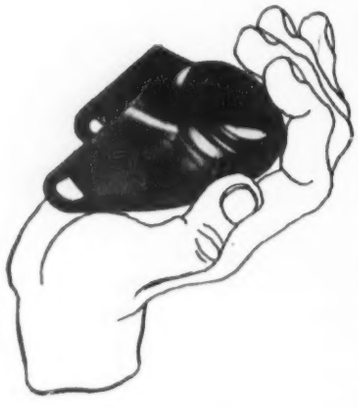
All mixers, containers, etc., must be kept absolutely clean.

Use daylight, not artificial light, for matching colors.

In making final adjustments for exact shade use very small quantities of color.

Add thinner after, not before, the desired shade is obtained.

To avoid waste, make the first batch a small one and record the quantities of colors used. Larger batches may be made from the formula if the correct match is obtained.



Protect Metal Surfaces with Johnson's Rust Inhibiting Waxes

•Today, rust is a real enemy of much war and other equipment. To help guard against it, the makers of Johnson's Wax have developed special Rust Inhibiting Waxes for use on untreated metal surfaces and on black oxidized and phosphated surfaces. These new waxes also provide a desirable *dry* finish. They are easy to apply, either by dip or spray methods. Coverage per gallon is excellent; drying is rapid.

Johnson's Rust Inhibiting Waxes are non-toxic, non-flammable. They are ready to use; no mixing or dilution is necessary.

Free test sample and full information gladly sent on request. Write

S. C. Johnson & Son, Inc.

Industrial Wax Division, Dept. MF43
Racine, Wisconsin
Canadian Address: Brantford, Ont.

★ BUY U. S. WAR BONDS AND STAMPS ★

Finishing Aluminum Parts For Military Aircraft

ALL commercial aluminum alloys possess corrosion-resistance properties, but the various alloys differ in their degree of resistance. Also, the presence of corrosive agents varies with the kind of exposure. Therefore the type of protective treatment, if necessary, depends upon the characteristics of the particular alloy and also upon the properties required to withstand service conditions.

With a few exceptions, unless otherwise specified, all aluminum alloy parts for military aircraft are anodized or receive a chromic acid dip treatment to provide effective paint adhesive properties to their surfaces. The chromic acid dip treatment forms a film similar in character to the anodic film, but is so thin that, in itself, it is not considered sufficient protection. It is, therefore, essentially a treatment to improve paint adhesion. Anodic treatment is not applicable under the following conditions:

1. Parts or assemblies on which have been assembled other parts or accessories fabricated of dissimilar metals, such as brass, bronze, iron or steel.
2. Die-castings in which a dissimilar metal part has been integrally cast.
3. Parts or assemblies that contain copper as an alloying element in quantities in excess of 5 percent.
4. Tanks or other assemblies wherein impregnated fabric or water-tight or gas-tight sealing compounds have been inserted between the faying surfaces.

Degreasing

Where large quantities of grease, oil, and scum have collected on aluminum or aluminum alloy parts, the first step in preparation for anodic or chromic acid dip treatment consists either of manual removal with a suitable solvent, soaking in a solvent, preferably non-volatile, or the use of a solvent vapor degreaser in which vapors of a stabilized trichlorethylene compound are permitted to condense on the parts in a specially constructed unit. For removal of paint, the parts are immersed in a hot solution of an approved paint stripping compound.

Reprinted with permission from "Product Engineering," February, 1943.

Material from which this article was prepared was submitted by F. A. Truden, process engineer, Vultee Aircraft, Inc.; J. Reinhardt, industrial subcontracting manager, Curtiss-Wright Corporation; and W. J. Montgomery, Sherwin-Williams Company.

Alkaline Wash

To remove other foreign matter, the parts are then cleaned in a silicate type alkaline wash solution containing no free caustic and having a satisfactory detergent action with no deleterious effect on aluminum or aluminum alloy parts. The compound should be equivalent to Navy Specification M-354. The cleaning solution is made by dissolving four to six ounces of the compound to one gallon of water. For best results, the temperature of the solution should be maintained at 180° F. The solution should be continuously agitated while the parts are being washed. After a period of five to fifteen minutes in this solution, the parts are removed and then rinsed in clean hot water at 180° F. If parts are properly cleaned, their surfaces should support a "non-break" water film.

Passivating Weld Flux

All welds in aluminum alloy parts should be cleaned by scrubbing in hot water. After a thorough scrubbing, the welds should remain in an unheated 10 percent solution of concentrated commercial sulphuric acid (66° Bé.) for not less than half an hour. When cleaning welded gas tanks and other closed members, the solution should be agitated freely within the closure to make sure that all welded areas are reached. This acid solution counteracts or passivates any flux which remains after welding. After removal from the acid bath the aluminum alloy parts should be rinsed in hot water, and then dried completely.

Anodic Treated Parts

After the hot water rinse following the alkaline wash, the passivation of the weld flux if necessary, all non-alclad aluminum alloy parts, sheet metal parts of alloys 17S and 24S, extrusions and forgings of alloys 14S, 17S and 24S, and castings of alloy 195 are given an anodic treatment. Under special instructions by a proper authority parts fabricated of 2S, 3S, 52S, 53S, 61S, and all alclads may be anodized.

The anodic treatment consists of immersing the aluminum alloy parts in a chromic acid electrolyte and passing an electric current through them, the parts forming the anode and the tank the cathode. The electro-chemical action forms films of aluminum oxide on the surfaces of the parts suspended in the electrolyte. This film of oxide possesses high corrosion resistance. The surface of the film is such that it promotes the adhesion of subsequent finishes.

In order to obtain maximum protection from the anodic coating, as much forming, milling and cutting as is practicable should be done on the parts prior to anodizing.

In general the parts should be completely immersed in the electrolyte during the anodic treatment. Parts should be suspended from the anode bar with clips, hooks, wires, baskets, or drilled containers made of only aluminum or aluminum alloy. When the size of the part prevents immersing it completely in the electrolyte, anodizing can be done by partial immersions, but care should be taken to have the successive treatments overlap. Also any suspension clips that grip previously anodized surfaces should have sharp-toothed jaws to insure satisfactory electrical

contact, because the aluminum oxide formed by the anodic treatment is a non-conductor. If the clips do not come into contact with the chromic acid electrolyte, they need not be made of aluminum or aluminum alloy.

All parts should be anodized in detail before assembly, except those parts assembled by welding and parts which will not be stressed. Disassembly should not be required when: (1) the assembly as finally placed in the structure will not be exposed to water or moisture, (2) there are no dissimilar metals in the assembly, (3) the assembly is a unit that will not be disassembled in service, (4) waterproofing or insulating fabric compounds are not present which the electrolyte would deteriorate, or (5) the final organic coating forms a continuous unbroken film. All faying surfaces where moisture may enter and be held because of capillary action must be protected with an anodic film, of course.

During the anodizing treatment the electrolyte should be agitated to prevent overheating of the anode. Agitation is especially important when anodizing parts which have rough surfaces or complicated shapes. On the other hand, agitation should not be overdone. When the electrolyte is overagitated, an anode may be impelled into contact with the tank wall thus causing a short circuit that will burn the aluminum part.

After anodizing, the parts should be handled as little as possible. When handling particular care must be taken not to soil the surface coating or to rupture the oxide film. Parts should not be handled with bare hands. Wire hooks or clean rubber gloves should be used wherever practicable. If the surface oxide is unavoidably soiled after anodizing it may be washed in a solution of sulphonated ether synthetic soap mixed with hot or warm water. No other cleaning agent should be used. After anodizing, the parts should be rinsed in clean water and then dried. When dry the parts should be sprayed immediately with a coat of zinc chromate primer.

Chomic Acid Dip Treatment

Unless otherwise specified, all aluminum alloy parts or assemblies, not to be anodized, fabricated from 2S, 3S, 52S, 53S, 61S, and all alclads, after the "alkaline wash" and clean water rinse, receive the chromic acid bath treatment. This consists of immersing the parts for five minutes in a 5 percent (by weight) solution of chromic acid. At all times during the treatment, the chromic acid solution should be agitated, and the bath temperature maintained at 130° F. to 160° F. After removal from the bath the parts are rinsed in clean hot water until all traces of the acid solution have been removed.

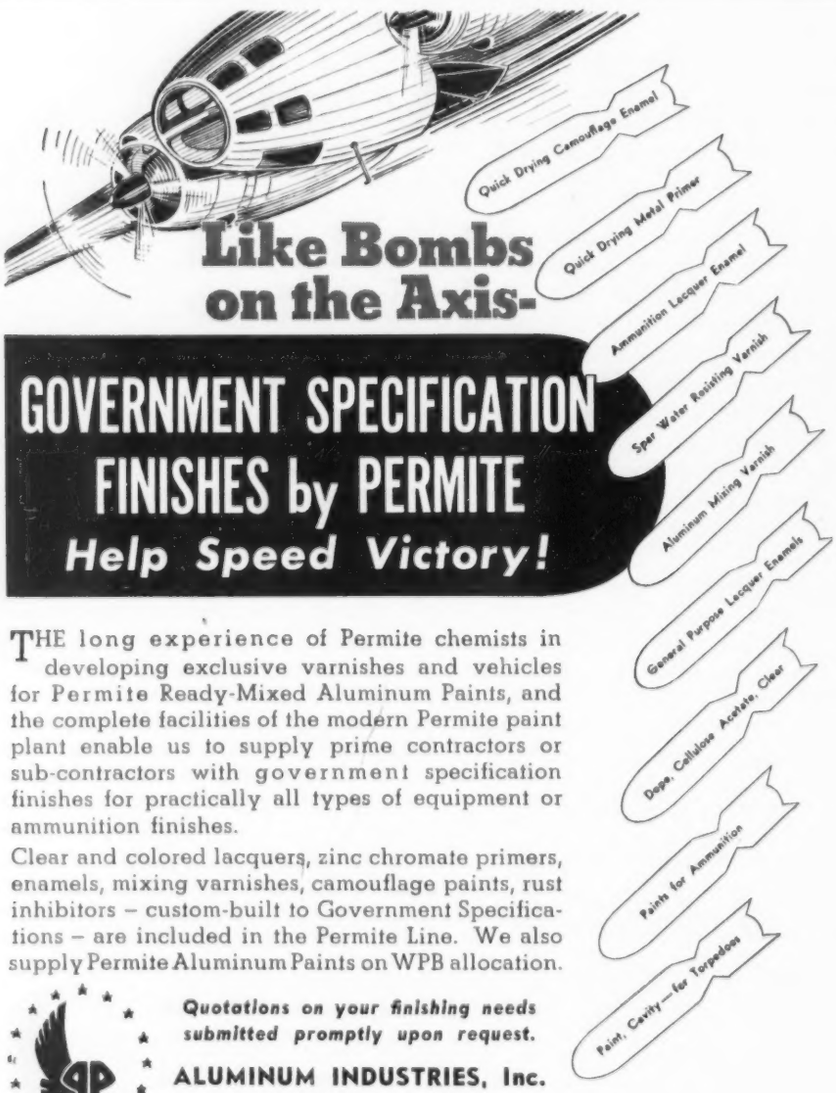
After the chromic acid etch treatment, all parts should be handled with clean rubber gloves. Care should be exercised to see that the etched parts are kept free of oil, grease, dirt, or other substances that might impair the paint adhesive properties of the oxide that has been formed on the surfaces.

Assemblies fabricated entirely of aluminum or aluminum alloy parts may be given the anodic treatment or the chromic acid bath dip whether the various parts have been joined by riveting or by means of resistance spot welding, provided that impregnated fabric or sealing compound has not been placed between the faying surfaces.

When dipping parts in the chromic acid bath, they should be suspended in the same manner as for anodizing, that is, by means of clips, hooks, wires, baskets, or drilled containers, fabricated entirely of aluminum or aluminum alloy.

Alcoholic - Phosphoric Acid Treatment

When it is inadvisable to use immersion methods, surfaces of aluminum or aluminum alloy parts may be treated with an alcoholic phosphoric acid solu-


Like Bombs on the Axis-
GOVERNMENT SPECIFICATION FINISHES by PERMITE
Help Speed Victory!
Quick Drying Camouflage Enamel
Quick Drying Metal Primer
Ammunition Lacquer Enamel
Spar Water Resisting Varnish
Aluminum Mixing Varnish
General Purpose Lacquer Enamels
Dope, Cellulose Acetate, Clear
Paints for Ammunition
Paint, Cavity—for Torpedos
THE long experience of Permite chemists in developing exclusive varnishes and vehicles for Permite Ready-Mixed Aluminum Paints, and the complete facilities of the modern Permite paint plant enable us to supply prime contractors or sub-contractors with government specification finishes for practically all types of equipment or ammunition finishes.
Clear and colored lacquers, zinc chromate primers, enamels, mixing varnishes, camouflage paints, rust inhibitors – custom-built to Government Specifications – are included in the Permite Line. We also supply Permite Aluminum Paints on WPB allocation.
Quotations on your finishing needs submitted promptly upon request.
ALUMINUM INDUSTRIES, Inc.
CINCINNATI, OHIO
PERMITE Industrial FINISHES

tion which can be applied either by brush or spray. The solution is permitted to remain on the surface for a few minutes, then washed with clean water and dried. Zinc chromate primer or finish coat shall be applied immediately thereafter.

Priming

This process consists of the application of zinc chromate primer meeting Army Spec. 14080, Navy Aero Spec. P-27-B-2 or Spec. AN-TT-T-P-656. The primer is reduced about 200 per cent with toluol or toluol substitute and applied by spray or brush to deposit a semi-transparent greenish yellow coat. A full hiding coat should be avoided. If the primed surfaces are not finished immediately, they should be cleaned before the application of the top coat.

Color Coat

After the application of the zinc chromate primer to the anodized or acid etched parts, color coats are then applied. For interior surfaces of passenger compartments, a darkened zinc chromate primer is generally applied. On exterior surfaces, a camouflage color coat is used. This coat may be either lacquer or synthetic enamel. Specification AN-TT-L-51 covers gloss lacquer materials. Army Specification 14105 and Navy Specification M-485 cover camouflage or non-specular lacquers. Navy Specification E5 and Army Specification 3-98 or 14109 cover synthetic enamel, either gloss or camouflage. Aircraft materials of this nature have a finely dispersed pigment to give maximum smoothness. Regardless of whether lacquer or enamel is used, the finish must be nonspecular.

Fast drying synthetic enamels are to a great extent displacing lacquers because of the greater hiding power. One coat of enamel will, as a rule, cover as well or better than two or three coats of lacquer. Enamels may, when necessary, be used directly over the bare metal, which is not acceptable with lacquers.

All surfaces should be thoroughly cleaned and dry at the time of application of any organic coating. Parts should not be handled by dirty or greasy hands after the final cleaning operation.

Polishing

Gloss finishes may be polished and waxed with the commercial materials on the market.

Corrosion Prevention Rules

1. Avoid all dissimilar metal contacts. Chemical composition dissimilarity in contact sets up latent galvanic potentials that produce electrolysis. Therefore, contact between dissimilar metals is to be avoided wherever possible. Where necesssary, all faying surfaces should be insulated either with inserts or zinc chromate primer.

2. When dissimilar metal contacts are unavoidable, all faying surfaces should be protected by: (a) Anodizing the bare aluminum alloy in contact with other metal or material, including alclad. (b) Anodize all aluminum alloy rivets. (c) If in contact with steel surfaces, protect the steel surfaces by cadmium plating. (d) Corrosion inhibit all detail parts before any subassemblies. (e) Use zinc chromate primer as additional protection on all faying or contacting surfaces. (f) Copper alloys and steel parts in contact with aluminum alloys should be cadmium plated and then insulated as follows: Metal joints and seams should receive two coats of finishing material. The second coat may be either an additional coat of metal primer or a coat of aluminum varnish or lacquer.

3. High purity aluminum alloys and alclads, whether or not exposed to weathering conditions, will resist corrosion for long periods, providing such surfaces are kept free of dust particles and continued exposure to moisture. Foreign bodies act as foci of corrosion, thereby setting up small local electrolytic couples which cause pitting.

MOST VITAL EVENT

of 1943

to every practical electroplater!

American Electroplaters' Society

31st ANNUAL CONVENTION

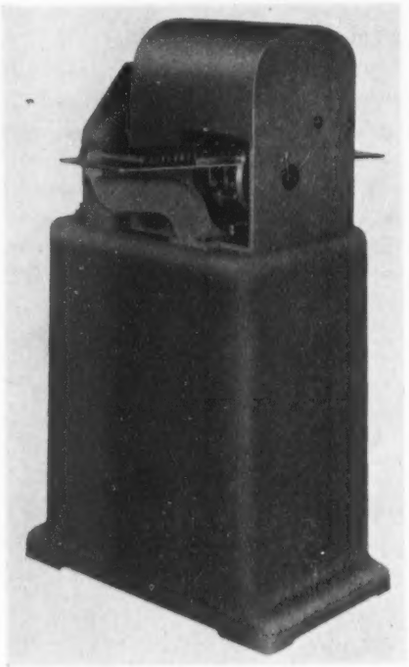
BUFFALO, N. Y. • HOTEL STATLER

June 7, 8, 9, 1943

3 days at Buffalo may SAVE you 3 months of wasted effort. Discuss the fast-moving developments in plating and finishing, the impact of war, and post-war trends . . . face-to-face with outstanding authorities!

NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING



Machine For Printing On Cylinders

Band Printing Machine

This newly developed machine is used for printing color bands, insignia and other important data on cylindrical bodies of grenades, signal flares, cartridge cases, etc. A machine can be designed for printing one or more colors. The machine illustrated prints 20 MM cartridges cases in one color.

The general operating principle of the machine consists of the following four main points:

1. An input gravity feed chute. Parts are placed into chute by hand and rolled by gravity to the printing unit.
2. Printing unit which consists of:
   a. A printing plate cylinder into which interchangeable synthetic rubber type is placed.
   b. Ink pan, roll and doctor which places ink on the face of printing plate.
   c. Cradle rolls which hold piece to be printed during printing operation. The cradle rolls are multiple stage and set into a shaft. The part being marked is picked up by one cradle roll and advanced to the printing stage. The piece is printed, and the cradle then moves forward and automatically deposits the printed piece on . . .
3. The gravity takeaway chute which permits the printed piece to roll on to the customer's receiving table or conveyor.
4. Drive is by ¼ H.P., geared head motor with a three speed cone pulley belt drive, to printing cylinder shaft.

The machine uses liquid inks, either dye or pigment colors. The inks are quick drying so that parts can be handled within 30 seconds after printing. Its production rate depends entirely on the operator's ability to keep the feed chute relatively full. A good operator should have little difficulty in marking from three to four thousand pieces per hour.

Floor space 18" x 30". Overall size: 34" x 30" x 54". Weight approximately 600 lbs. Prices on machine will be quoted on receipt of specifications by Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh, Pa.

Aluminum Treatment

Turco Products, Inc., has announced their W. O. No. 1 treatment for obtaining adhesion of organic finishes to aluminum alloys. It is stated that this method gives adhesion which is thoroughly satisfactory—not more than slightly inferior to that obtained with anodizing—and that it requires little time, can be carried out without special equipment, and is applicable to sections too large for tank immersion.

Information may be obtained by writing to the company at 6135 South Central Ave., Los Angeles, Calif.

Cleaner

M. S. Metal Shampoo Cleaner, to replace naphtha or kerosene in grease cleaning and hand wiping operations, is announced by The Curran Corporation, Malden, Mass.

A mild aliphatic glycol solvent comprising amino soaps (triethanolamine type), this material may be diluted with three to 30 parts of water and used by wiping, brushing, spraying and hot or cold immersion. It is said to not only clean but to remove and prevent sweat stains and corrosion of metal parts. It is also stated to have no flash point and to be non-toxic and non-drying to hands. It is recommended for general purpose grease cleaning in factories, machine shops, engine rooms, airplane hangars, etc., as well as for many special cleaning jobs.

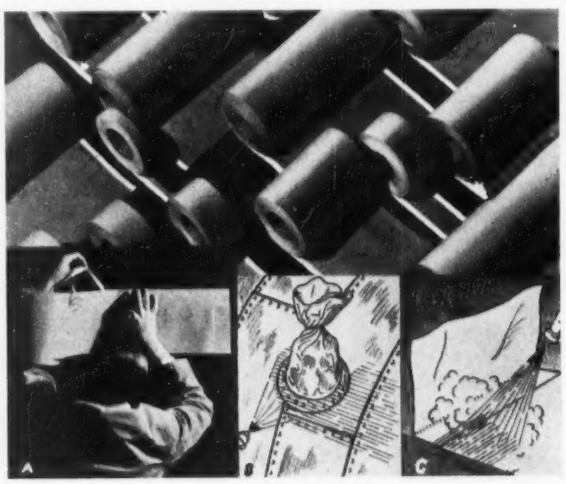
Masking Paper

Masking paper in rolls, with the edge already gummed and ready to apply, is a new timesaver produced by Adhere, Inc., 1220 Maple Ave., Los Angeles, Calif., who specialize in developing improvements on the ordinary paper-and-tape method of masking.

The advantages claimed for Adhere Edge-gummed Masking Paper in Rolls are that only one piece is handled, thus avoiding cutting and handling both a large sheet of paper and the masking tape. In fact, women operators in one war plant went a step further and conceived a novel method of slipping the roll over the forearm and applying it direct from the roll as shown in illustration "A".

This ready-to-apply masking paper lends itself readily to masking flat surfaces, straight edges, striping, and for covering protruding parts. It is claimed to be especially useful in the maintenance department of any air, marine or mobile equipment.

Users, such as aircraft manufacturers, have adopted the simplified method in their painting and camouflage departments for masking wing de-icers, wing catwalks and such protruding parts as porcelain insulators, gun mount sockets and control knobs as shown in illustration "B". A vertical masking apron may also be formed by turning and folding the paper upwards as shown in "C."



Masking Paper Applications

The paper is light in weight and treated to resist paint. The gummed edge is protected with cover tape.

Adhere Masking Paper in Rolls is produced with single edge gummed or with both edges gummed. Standard rolls are 200 feet long and in widths of 3, 6, 9, 12, 18, 24 and 35 inches. Other widths are available on special order.

BY-PRODUCTS OF RESEARCH IN WAR CHEMISTRY

These Practical Products Have Been Developed through Research in Colloidal Chemistry and May Be Found Applicable to Your Business.

Self-Emulsifying Safety Solvent dilutes with water to replace naphtha, gasoline, or benzine for grease-cleaning, hand-wiping operations in metals-processing plants. Contains no chlorinated compounds, has no flash or fire point and does not tend to defat the skin. (Data Sheet #210)

Hydro-Sealed by floating water blanket, new high-performance Carbon Gum Digestive Solvent cleans carbon and paint from aircraft engine parts without harmful effect. Used hot, water seal prevents escape of solvent vapors. (Data Sheet #211)

High Potency Concentrate makes Self-Emulsifying Grease Solvent to remove insulating coats of grease and dirt from truck, jeep, tank, and automobile engines by emulsification and utilizing the heat of a warm engine. Cleaned engines operate more economically since original thermal efficiency is restored. (Data Sheet #212)

Unique Oil removes salt; may be applied to metal surfaces wet with sea water. Cleans, dehydrates and leaves thin film of rust-preventive compound. Suitable as a cleaner-preservative and lubricant for small-arms bore cleaning. (Data Sheet #213)

High Boiling Dehydrating Oil absorbs residual water from parts, storage tanks or equipment. Recovery for repeated use made by simple heating above 212° F. (Data Sheet #214)

Trichlorethylene Replacement . . . non-volatile cleaning and scouring solvent for large cold tanks . . . rinses with hot water. Long solution life. (Data Sheet #215)

New Fuel Concentrate raises low-test gasoline to high anti-knock rating motor fuel . . . especially applicable for high-compression motorcycle engines . . . increases performance. (Data Sheet #216)

Sparkling Clear, water-in-oil cooling compound emulsion facilitates work inspections without stopping tools in metal-cutting and grinding operations. (Data Sheet #217)

Emulsifying Compound cleans oil from camouflage paints; restores dead, flat, lusterless surface. Shipped as a concentrate. (Data Sheet #218)

Instrument Shampoo emulsifying solvent cleans optical lens and delicate mechanisms without harmful effect. Results in physically clean work and complete absence of any film. (Data Sheet #219)

Fluid, Pre-Paint Cleaning extracts and emulsifies all traces of wax, oil, and grease from hard surfaces. Rinses with water . . . leaves no film. (Data Sheet #220)

Non-Caustic Emulsion cleans brass and steel shell cases. Solution may be handled safely by women. Cold or hot solutions are effective. (Data Sheet #221)

Light Preservative Oil (Polar Type) cleans and removes the acid perspiration touch of fingers, salt spray, soldering flux, and removes water. (Data Sheet #222)

Gunk . . . this versatile base concentrate when diluted with appropriate solvents anticipates every automotive, military, and industrial grease-cleaning problem. (Data Sheet #223)

FOR FURTHER INFORMATION

Make letterhead request referring to Data Sheet Numbers.

Gunk CLEANS CLEAN

Curran (Canada) Limited Chambly Canton, P.Q., Canada

Agateen LACQUERS

All types of Clear Lacquer for Metals

BUFFING LACQUER

for Cloisonne Reproductions

Air-Dry Priming Lacquer

Water Dip Lacquer

Elastic ***Non-blushing***

Agate Lacquer Mfg. Co., Inc.

11-13 Forty-third Road

LONG ISLAND CITY, N. Y.

Agateen—***The Last Word in Quality***

Testing finishes simplified by Taber ABRASER

Comparative tests for adhesion, wearability and toughness of paint, lacquer, enamel, electroplate and similar finishes are accurately made from four-inch specimens.

Results totalled on built-in counter in terms of wear cycles.

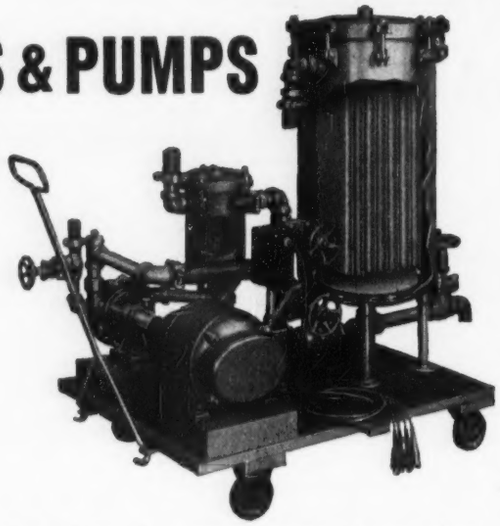
Write for Bulletin 2014 NOW.

TABER INSTRUMENT CORP.

111 MF GOUNDRY ST., NORTH TONAWANDA, N. Y.

Designers and Builders of Precision Scientific Apparatus

FILTERS & PUMPS



For Filtering, Pumping, or Circulating:—

ELECTROPLATING SOLUTIONS
DEGREASING SOLVENTS
CLEANERS
OILS
COOLANTS
LACQUERS
KEROSENE
VARNISH
ALCOHOL & OTHERS

We carry a large stock of Filter & Pump accessories, hose, valves, fittings. All grades of filter cloth, filter aids, & FILTERBESTOS. Ready for shipment.

SALT SPRAY

CORROSION TEST EQUIPMENT

Designed to determine the corrosion resisting qualities of plated or coated metal, alloys, metal parts, organic finishes, etc. This equipment combines necessary features so that Salt Spray tests can be conducted to specifications at Controlled Temperatures to 130 Deg. Fah.

"Write for New Literature and Particulars"

INDUSTRIAL FILTER & PUMP MFG. CO.

3017 WEST CARROLL AVENUE — CHICAGO, ILLINOIS

Remember Pearl Essence

The Selective Substitute for Metallic Finishes

GUNMETAL — NICKEL

BRASS — BRONZE

Available in Unlimited Quantities

THE MEARL CORPORATION

153 Waverly Place — New York, N. Y.

Shop Problem

Problem 8. Cured Film Density

Problem: A finishing laboratory wishes to determine the density of a film of air-dried lacquer which was applied to a formed sheet metal piece. Because the piece is of irregular shape and because the lacquer film appears to have been applied somewhat unevenly, it is not possible to determine the density from measurements of the weight and thickness of a given area of the film.

Solution: The density of a cured film of finishing material of uneven thickness or applied to an irregularly shaped object may be determined by taking advantage of the fact that a body immersed in water is buoyed up by a force equal to the weight of the volume of displaced water.

Four data are necessary, all of them weights. They are: weight of finished object in air (Ta), weight of finished object in water (Tw), weight of bare object in air (Pa), and weight of bare object in water (Pw).

The density of the cured film of finishing material is calculated from the following equation:

$$\text{Density} = \frac{(Ta - Pa)}{(Ta - Pa) - (Tw - Pw)}$$

For example, a finished piece weighs 62.04 grams in air (Ta) and 53.06 grams suspended in water (Tw). The finish is removed and the bare object weighs 60.12 grams in air (Pa) and 52.30 grams in water (Pw). Substituting these values in the equation,

$$\text{Density} = \frac{(62.04 - 60.12)}{(62.04 - 60.12) - (53.06 - 52.30)} = 1.655$$

New Sales and Ad Head for Lacquer & Chemical Corp.

The Lacquer and Chemical Corp., 214-224 40th Street, Brooklyn, N. Y., manufacturers of lacquers, thinners, synthetic enamels and other product finishes, have appointed *Morton H. Schwartz* as director of advertising and sales.

For 14 years, Mr. Schwartz was the advertising and sales promotion manager of the A. C. Horn Company, Long Island City, manufacturers of paints and waterproofings.

Manufacturers' Literature

Water Wash Compound

Turco Deflocculator, a dry, dustless, non-segregating granular powder designed for the treatment of the water in water wash spray booths, is described in a one-page bulletin published by *Turco Products, Inc.*, 6135 South Central Ave., Los Angeles, Calif.

This material is quickly soluble and it is not necessary to boil it in order to dissolve it before charging into the water tank. The bulletin states that it is composed entirely of powerful ingredients and has a high buffer index and high colloidal activity.

Used in initial charge in amounts of ⅓ oz./gal. with further additions of 1/6 oz./gal. every four hours during operations, the compound is said to readily wet out the oil and resin portions of organic finishing materials and thoroughly disperse pigments, thus keeping the metal walls clear of finishing materials and the water curtain free of breaks.

Paint Stripper

Turco Products, Inc., 6135 South Central Ave., Los Angeles, Calif., has issued a four-page bulletin describing Turco Stripper L-595, a wax free stripper for removing organic finishes.

A clear liquid of high viscosity, low evaporation rate, and a slight pleasant odor, this material may be applied by brush or spray gun of the non-atomizing type and is said to loosen coatings in five to fifteen minutes, depending on the type of finish to be removed.

According to the bulletin, Turco Stripper L-595 does not attack polished copper, cadmium plate, magnesium alloy, anodized aluminum alloy, etc., and will not injure fabrics with the exception of rayon. It is said to be absolutely non-inflammable and to contain no chloroform, ether, carbon tetrachloride or any of the conventional chlorinated hydrocarbon solvents.

Plastex Protective Coating

Steel Protection and Chemical Co., Inc., Mooresville, Ind., has issued a leaflet describing their Plastex Colorcoat. This coating material is recommended by the manufacturer for application to metal, stone, tile, brick, concrete, plaster and wood where conditions are exceptionally severe and maximum protection is desired. Plastex Colorcoat is said to be waterproof, unaffected by acids, acid vapors, alkalis and salt solutions, and highly resistant to fungus and bacterial growths. It may be applied by brush or spray, dries in about one hour and covers from 300 to 500 square feet per gallon, depending on the condition of the surface to which it is applied.

The leaflet contains chips illustrating the various standard colors in which Plastex Colorcoat is made. Many shades or tints are also available.

Insulating Varnishes

The P. D. George Co., of St. Louis, Mo., manufacturers of Pedigree Insulating Varnishes and Compounds, have announced the publication of their new Insulating Varnish Catalog.

This illustrated, 36 page varnish guide contains data on over forty different materials, each graphically described in easy-to-read charts.

Along with the essential technical information offered, are striking illustrations of production and laboratory operations. Copies are available upon request.

Care of Paint Brushes

New instructions in the care of paint, varnish and lacquer brushes, now being manufactured from war-created substitutes, have been prepared by the *Osborn Manufacturing Company*, Cleveland, O., in a booklet entitled "Care and Conservation of Brushes". The reasons why proper care of brushes is imperative along with suggestions for their preservation are given.

Use of brushes for finishing the surfaces of war equipment is placing heavy demands upon their durability and because many sea lanes are closed, substitutes such as horsehair and substitute cements must be used. Under the war emergency program, brushes are made with 55 per cent of the customary hog bristle, which gave the paint brushes manufactured prior to the war their wearing quality and ability to resist rough treatment.

In addition to giving instructions on care of brushes already in use, the booklet lists many helpful details on the way to break in new brushes. It may be obtained by writing to the Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.

Hercules Powder Co., Wilmington, Del., opens sales offices in Boston on April 1, for its cellulose products, naval stores, synthetics, explosives and paper makers chemical departments. The offices are on the seventh floor of the Statler Office Building.

Obituary

ALFRED E. HEROUX
Dies of Heart Ailment

Alfred E. Heroux, sales manager of the Paint Division of Aluminum Industries, Inc., Cincinnati, O., died of a heart ailment on Sunday, March 7th, after a lingering illness extending over several months. His widow, Ethel (nee Marshall), and two children, Audrey Ann and Alfred, Jr., survive him.

Mr. Heroux, known as "Al" to his host of friends in the Industry, joined Aluminum Industries as a member of the Detroit office in June, 1933. In September, 1935, he was transferred to Cincinnati as sales manager of the company's Paint Division. He served in this office until his death.

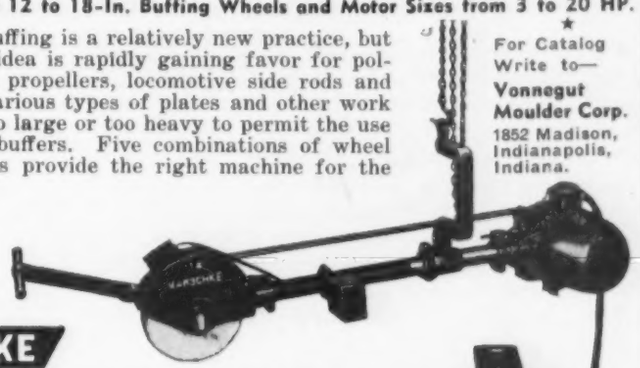
Prior to his affiliation with Aluminum Industries, Mr. Heroux was associated with the Commercial Electric Company of Detroit and the Detroit Supply Company.

Superb MARSCHKE A.C. Swing Frame Buffers

In Four Sizes for 12 to 18-In. Buffing Wheels and Motor Sizes from 3 to 20 HP.

Swing frame buffing is a relatively new practice, but this Marschke idea is rapidly gaining favor for polishing airplane propellers, locomotive side rods and link motions, various types of plates and other work pieces either too large or too heavy to permit the use of floor stand buffers. Five combinations of wheel and motor sizes provide the right machine for the particular job.

★ For Catalog Write to— Vonnegut Moulder Corp. 1852 Madison, Indianapolis, Indiana.



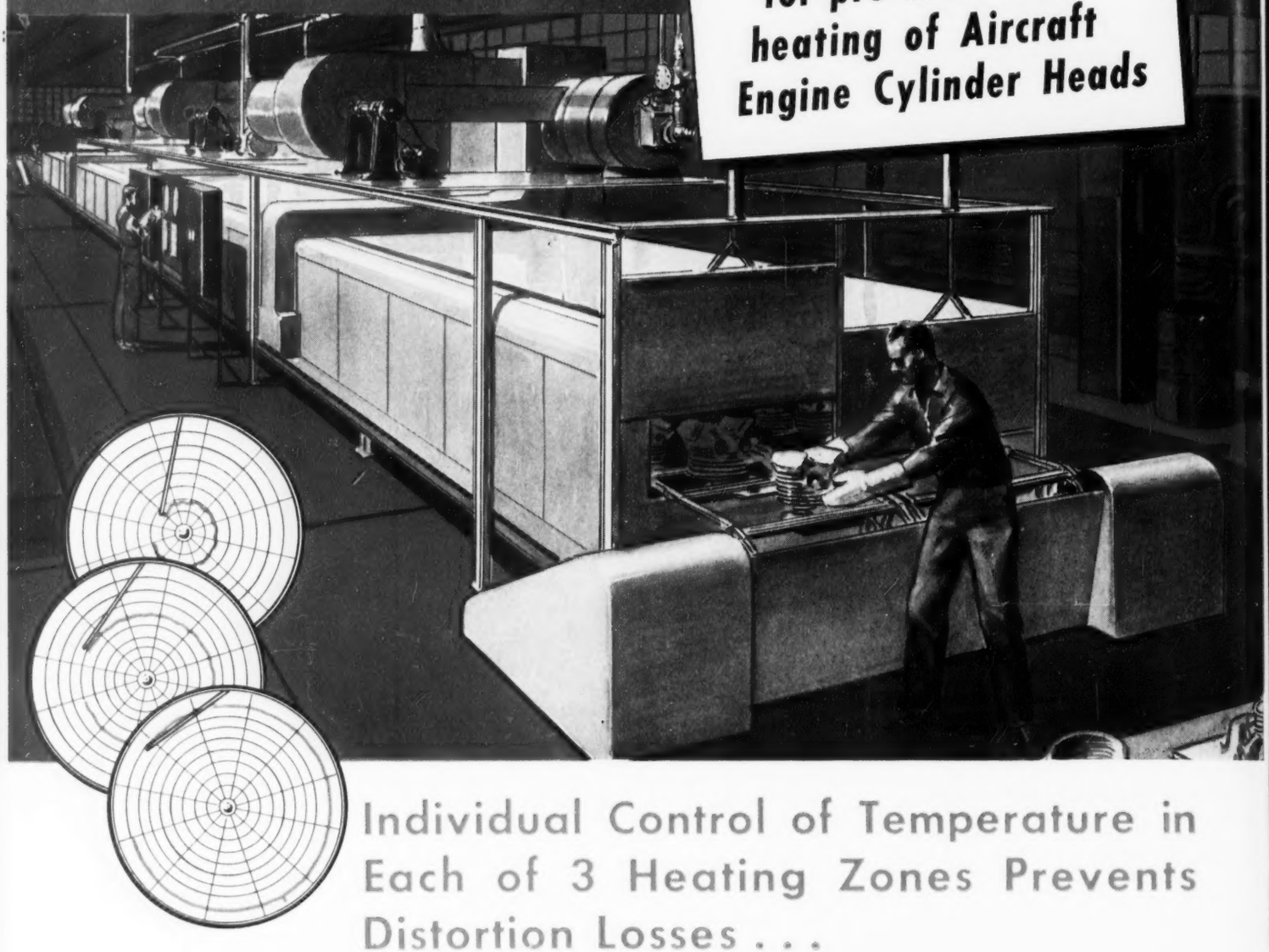
MARSCHKE QUALITY GRINDERS AND BUFFERS

Marschkes exceptionally high buffing efficiency results from the pyramided advantages of smooth spindle rotation, multiple spindle speeds, simplicity of changing wheels and wheel speed, balance and maneuverability.

★ VONNEGUT MOULDER CORP. INDIANAPOLIS

Another MAHON *Shrink* OVEN Installation . . .

for pre-assembly heating of Aircraft Engine Cylinder Heads



Individual Control of Temperature in Each of 3 Heating Zones Prevents Distortion Losses . . .

Here is a *new* shrink oven design—that speeds up the pre-assembly heating of aircraft engine cylinder heads—*reduces distortion losses to a minimum.* It was developed by Mahon research engineers, in collaboration with the engineering staffs of leading airplane engine manufacturers.

Unlike conventional shrink oven construction, this oven is divided into three separate compartments or zones, with the temperature in each zone individually controlled. As the heads pass from zone to zone they are brought to the required temperature by a graduated heating process. Distortion—caused by too rapid heating—does not occur. Resulting spoilage is avoided.

Two rows of cylinder heads traverse the oven progressively through the three heat zones on independently operated slat conveyors. Heads are placed on the two conveyor lines in staggered formation—emerging from the oven one at a time—for quick transfer to the assembly table in a continuous production flow.

Airplane engine manufacturers are making installations of these new ovens as rapidly as they can be produced. Several, now in operation, are effecting highly satisfactory savings. If you would like to know more about this improved shrink oven design—or the many short cuts and economies that other Mahon equipment makes possible—write or phone for an interview—at your convenience and without obligation.

THE R. C. MAHON COMPANY

DETROIT — CHICAGO

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Supply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems

BUSINESS WANTS For Sale—Equipment, Etc.

Display Advertisements, One Column Wide, $6 per inch, Each Insertion

FOR SALE
(AVAILABLE FOR IMMEDIATE SHIPMENT)

1—10000/5000 AMPERE, 6/12 VOLT, "COLUMBIA" Motor Generator Set. Synchronous Motor drive. Excellent Condition. Full Panel-Board Arrangement. **READY FOR IMMEDIATE SHIPMENT.**

2—5000/2500 AMPERE, 6/12 VOLT, HANSON & VAN WINKLE CO. "OPTIMUS" Motor Generator Sets. Full Panel-Board Arrangement. Excellent Condition.

1—3000/1500 AMPERE, 6/12 VOLT, MUNNING "OPTIMUS" Motor Generator Set. Full Panel-Board Arrangement. Excellent Condition.

1—2000 AMPERE, 6 VOLT, JANTZ & LEIST Motor Generator Set. Full Panel-Board Arrangement. Excellent Condition.

1—1500/750 AMPERE, 6/12 VOLT, "OPTIMUS" Motor Generator Set. Full Panel-Board Arrangement.

1—1000/500 AMPERE, 6/12 VOLT, HANSON & VAN WINKLE CO. Motor Generator Set. Full Panel-Board Arrangement. Excellent Condition.

1—1000/500 AMPERE, 5/10 VOLT, "OPTIMUS" Motor Generator Set. Full Panel-Board Arrangement.

1—750/375 AMPERE, 6/12 VOLT, BENNETT & O'CONNELL ELECTRIC CO. Motor Generator Set. Full Panel-Board Arrangement. Excellent Condition.

1—750 AMPERE, 6 VOLT, HANSON & VAN WINKLE CO. BELT-DRIVEN GENERATOR. Complete with Panel-Board.

1—750/375 AMPERE, 6/12 VOLT, CHARLES J. BOGUE Motor Generator Set. Excellent Condition. Full Panel-Board Arrangement.

1—ILG ELECTRIC VENTILATING CO. Motor-driven Blower Unit. Size B-35. Excellent Condition.

1—HILL-CURTIS COMPANY MOTOR-IN-BASE HEAVY DUTY POLISHING AND BUFFING LATHE. Split Shaft Design with 3 HP motor on each shaft. Excellent Condition.

1—BAIRD MACHINE COMPANY, DOUBLE NO. 2 SIZE, BELT-DRIVEN BALL BURNISHING BARREL UNIT. Excellent Condition.

1—LA SALCO, INC. SINGLE NO. 1 SIZE, BALL-BEARING, MOTOR-DRIVEN, BALL BURNISHING BARREL. New.

1—LA SALCO, INC. SINGLE NO. 2 SIZE, BALL-BEARING, MOTOR-DRIVEN, BALL BURNISHING BARREL. New.

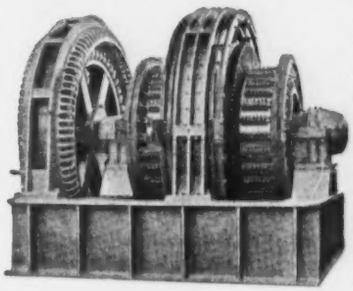
MANY OTHER SIZES IN STOCK

BAIRD & ABBOTT—Burnishing and Tumbling Barrels, Polishing Lathes, Rheostats, Ammeters, Blowers, Tanks, Polishing Wheels and many other items for the Plating and Polishing Department.

WRITE FOR DETAILS

M. E. BAKER COMPANY
143 Sidney St. Cambridge, Mass.

REBUILT AND GUARANTEED
Polishing and Plating Equipment



Largest and most complete stock of plating generator sets in America, too numerous to list, 100 amperes to 7500 amperes, 6/12 volts. Rheostats, Tumbling, Burnishing and Mechanical Plating Barrels.

Polishing & Buffing Lathes—Belt Drive, Motor Drive and Multi "V" Belt Drive.

Blowers, all sizes, belt and motor driven.

We carry a complete line of plating and polishing equipment and supplies.

Whatever your requirements may be in the plating and polishing line—call us for prices before placing your order.

WRITE — PHONE — WIRE

CLINTON SUPPLY CO.
112 So. Clinton Street Chicago, Illinois
Phone, Franklin 3538-3539

FOR SALE

2—Motor Generator Sets, 750 Amperes, 20 Volts. Like new.

1—Motor Generator Set, 1500 Amperes, 6 Volts. Rebuilt.

CAnal 6-3956-7

BEAM-KNODEL COMPANY
195 Lafayette St., N. Y. City

CONTRACT FINISHING

—PARKERIZING—

- Complete Plating Services. • All Metals
- Unlimited Production Capacity for Wartime Jobs
- Storage and Direct Shipping Facilities
- Complete Laboratory and Engineering Service
- Government and S.A.E. Specifications Guaranteed

United Platers, Inc., 987 Madison, Detroit, Michigan.
Telephone: RAndolph 4050 for rush quotation.

CHROMIUM, CADMIUM, ZINC and TIN PLATING

Chemical and Metallurgical Laboratories
Commercial Steel Treating

AGERSTRAND CORPORATION
Muskegon, Michigan

EQUIPMENT WANTED

WANTED

Buff Sewing Machines with Automatic Sewing Attachment. Give full particulars. Address Sewing Machine, care Metal Finishing, 11 West 42nd Street, New York, N. Y.

WANTED

Plating Barrels, 14x36 or larger, Udylite, Hanson-Van Winkle, motor driven. We do not want wooden barrels or tanks. Address Barrels, care Metal Finishing, 11 West 42d Street, New York.

BUSINESS WANTS For Sale—Equipment, Etc.

Display Advertisements, One Column Wide, $6 per inch, Each Insertion

PLATING GENERATORS

50 amp. 6 volt Leland with single phase 60 cycle motor.

60 amp. 7½ volt Eager with 3 phase 60 cycle M.D.

90 amp. 8 volt Continental, 1750 RPM.

150/75 amp. 7½ 15 volt Eager.

150 amp. 7½ volt Roth with single phase 60 cycle motor.

15/75 amp. 6/12 volt Columbia.

200 amp. 7½ volt Gen. Electric with 3 phase 60 cycle M.D.

200 amp. 7½ volt Hobart with 3 phase 60 cycle M.D.

250 amp. 7½ volt Rochester.

1000/500 amp. 6/12 volt Chandeyson with 3 phase 60 cycle M.D.

1000/500 amp. 6/12 volt Meaker with 3 phase M.D.

The Motor Repair & Manufacturing Co.
1555 Hamilton Avenue Cleveland, Ohio

"If it's metal finishing equipment—we have it."

PLATING EQUIPMENT & SUPPLY CO.

Plating Dynamos
Motor Generator Sets
Plating Barrels—Tumbling Barrels

Plating Tanks	Ammeters	Filters
Polishing Lathes	Wheels and Buffs	Ovens
Anodes	Rheostats	Spray Booths
Spraying Systems	Voltmeters	Blower Systems

1—3000/1500 amperes, 6/12 volts, IIVW motor generator set, full panel board, perfect condition and
1—Acme Ball bearing aerial swing frame grinder.

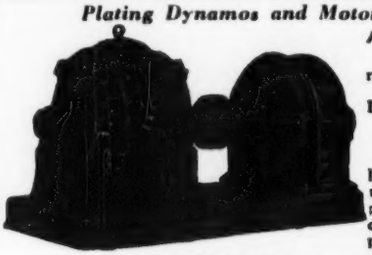
If you want to BUY call us—if you want to SELL call us.

182-184 Grand Street New York, N. Y.

REBUILT AND GUARANTEED

POLISHING AND PLATING EQUIPMENT

Plating Dynamos and Motor Generator Sets



All Sizes Carried in Stock

Tumbling and Plating Barrels and most anything for the Plating Shop.

Largest Stock of Rebuilt Polishing and Plating Equipment in America

Let us have your requirements. Entire plants or parts thereof bought for cash. Send us list with prices.

J. HOLLAND & SONS, INC.
274 South 9th Street, at Broadway, Brooklyn, N. Y.
EVergreen 7-3314—3315—3316

FOR SALE

5000 sections of 6" bias buffs. New and slightly used. Lewis Roe Mfg. Co., 1042-1050 DeKalb Ave., Brooklyn, N. Y. Manufacturers of plating and polishing equipment.

FOR SALE

We carry the largest stock of slightly used Buffs in the country. All sizes in stock from 6 inches to 14 inches. All sizes loose, sewed and flannel buffs in stock. We also have all sizes slightly used emery wheels and stone wheels. Established over twenty years.

LEWIS ROE MFG. CO.
1042-1050 DeKalb Avenue, Brooklyn, N. Y.

SITUATIONS OPEN

PLATER

Large manufacturing plant in Newark has opening for a man with 5 to 10 years practical experience and with technical knowledge of electroplating. Firm now on 100 percent war production with extensive peacetime program. Those engaged in war work at highest skill not considered. State full particulars of age, education, experience, salary desired. Address Box, V care Metal Finishing, 11 West 42nd St., New York, N. Y.

WANTED

Man with Hard Chromium Plating experience. Write, giving age, draft status, experience and salary desired. Excellent opportunity for right man. Address W. A., care Metal Finishing.

PLATING ENGINEER

Chemist or metallurgist to work on electroplating and anodizing development and laboratory production control. Position in Chicago area. Address R. B., care Metal Finishing.

HELP WANTED—SALESMEN

Sales Engineer by old established manufacturer of complete line industrial synthetic enamels, lacquers, etc. Territory midwest section. Salary and bonus. Write stating qualifications, age, etc. Our men know of this ad. Address Enamels-Lacquer, care Metal Finishing, 11 West 42nd St., New York.

SUPERINTENDENT

SITUATION OPEN—Superintendent large industrial plant in Detroit requires the services of a plating Superintendent. Must be experienced in production methods. In your reply state age, experience in detail, draft status, salary expected and any other information you feel is pertinent. Address Box April 1, care of Metal Finishing, 11 West 42nd St., New York.

CLEANER SALESMAN

acquainted with the plating industry or with experience in selling cleaners, wanted for travel for excellent firm. Address Box 180, care Metal Finishing, 11 West 42nd Street, New York, N. Y.

INDEX TO ADVERTISERS

A

Abbott Ball Co., Hartford, Conn. 231
Acme Mfg. Co., Detroit, Mich. 5
Agate Lacquer Mfg. Co., Long Island City, N. Y. 261
Agerstrand Corp., Muskegon, Mich. 34
Aluminum Industries, Inc., Cincinnati, Ohio. 258
Alsop Engineering Corp., Milldale, Conn. 16
American Instrument Co., Silver Spring, Md. 26
American Machine & Metals, Inc., East Moline, Ill. 12
American Nickeloid Co., Peru, Ill. 238

B

Baird Machine Co., The, Bridgeport, Conn. .. 6
Baker & Co., Inc., Newark, N. J. 25
Baker, M. E. Co., The, Cambridge, Mass. 33
Barber-Colman Co., Rockford, Ill. 232
Beam Knodel, Inc., New York. 33
Beckman Instruments Div. National Technical Laboratories, South Pasadena, Cal. 8
Belke Mfg. Co., Chicago, Ill. 11
Bristol Brass Corp., The, Bristol, Conn. 239
Buckingham Products, The, Detroit, Mich. 221

C

Chicago Wheel Mfg. Co., Chicago, Ill. 253
Chromium Process Co., Shelton, Conn. 239
Clinton Supply Co., Chicago, Ill. 33
Crown Rheostat & Supply Co., Chicago, Ill. . 230
Curran Corp., Malden, Mass. 261

D

Darco Corporation, New York, N. Y. 10
Detroit Rex Products Co., Detroit, Mich. Back Cover
Du Bois Co., Cincinnati, O. 224
Dulite Chem. Corp., Middletown, Conn. 24
E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del. 13

E

Egyptian Lacquer Mfg. Co., New York, N. Y. 248
Enthone Co., New Haven, Conn. 3, 233, 247

G

General Abrasive Co., Inc., Niagara Falls, N.Y. 228
Gifford Wood Co., New York, N. Y. 254
Green Electric Co., W., New York, N. Y. 27
Gumm Chemical Co., Inc., Frederick, Kearney, N. J. ..... Inside Front Cover

H

Hamilton Emery & Corundum Co., Chester, Mass. 239
Hanson-Van Winkle Munning Co., Matawan, N. J. 31, 32
Harrison & Co., Haverill, Mass. 234
Harshaw Chemical Co., The, Cleveland, Ohio. 22
Hartford Steel Ball, Hartford, Conn. 35
Hay Co., Jacob, Chicago, Ill. 238
Heatbath Corp., Springfield, Mass. 18
Hogaboom, G. B. Jr., & Co., Newark, N. J. .. 220
Holland & Sons, Inc., Brooklyn, N. Y. 34
Houghton & Co., E. F., Philadelphia, Pa. 229
Hunnewell Soap Co., Cincinnati, Ohio 252

I

Indium Corp. of America, The, Utica, N. Y. .. 30
Industrial Filter & Pump Mfg. Co., Chicago, Ill. 262

J

Johnson & Son, Inc., S. C., Racine, Wisc. 256

K

Kalamazoo Tank & Silo Co., Kalamazoo, Mich. 238
Keystone Emery Mills, Philadelphia, Pa. 239
Keystone Carbon Co., St. Marys, Pa. 223
Kirk & Blum Mfg. Co., Cincinnati, Ohio 19
Kocour Co., Chicago, Ill. 233
Kushner, Joseph, New York 92

L

LaMotte Chemical Products, Baltimore, Md. .. 237
Lasalco, Inc., St. Louis, Mo. 20
Lea Mfg. Co., The, Waterbury, Conn. Front Cover
L'Hommedieu & Sons Co., Chas. P., Chicago, Ill. 9
Lupomatic Tumbling Machine Co., New York, N. Y. 239

M

MacDermid Incorporated, Waterbury, Conn. Inside Back Cover
Magnuson Products Corp., Brooklyn, N. Y. .. 224
Mahon Co., R. C., Detroit—Chicago 264
McAleer Mfg. Co., Detroit, Mich. 227
Mearl Corp., New York, N. Y. 262
Michigan Chrome & Chemical Co., Detroit, Mich. 226
Mine Safety Appliances Co., Pittsburgh, Pa. .. 221
Mitchell-Bradford Chem. Co., Bridgeport, Conn. 231
Motor Repair Co., Cleveland, O. 34
Munning & Munning, Inc., Newark, N. J. 239
Mutual Chemical Co. of America, New York, N. Y. 234

N

National Sherardizing & Mach. Co., Hartford, Conn. 239
Novitsky, Jos., Hollis, L. I., N. Y. 236

O

Oakite Products, Inc., New York, N. Y. 4
Oriental Rouge Co., Bridgeport, Conn. 35

P

Pennsylvania Salt Mfg. Co., Philadelphia, Pa. 7
Phelps Dodge Refining Corp., New York, N. Y. 236
Platers Technical Service Co., New York 220
Plating Equipment & Supply Co., New York . 34
Platt Bros. & Co., The, Waterbury, Conn. 238
Precimet Laboratories, New York, N. Y. 223
Procter & Gamble, Cincinnati, Ohio 247
Puritan Mfg. Co., Waterbury, Conn. 238

Q

Quinn, Nelson J., Toledo, Ohio 225

R

Rhodes, James H., & Co., Chicago, Ill. 232
Roberts Rouge Co., Stratford, Conn. 35
Roe Mfg. Co., Louis, Brooklyn, N. Y. 34
Rolock, Inc., Fairfield, Conn. 237

S

Sarco & Co., Inc., New York, N. Y. 235
Simpro Corp., Newark, N. J. 238
Sparkler Mfg. Co., Mundelein, Ill. 26
Speer Carbon Co. St. Marys, Pa. 14
Spraying Systems Co., Chicago, Ill. 235
Standard Plating Rack Co., Chicago, Ill. 238
Stevens, Inc., Frederic B., Detroit, Mich. 15
Stutz, George A., Mfg. Co., Chicago, Ill. .. 224
Sulphur Products Co., Greensburg, Pa. 230

T

Taber Instrument Corp., North Tonawanda, N. Y. 261
Technical Processes Div. of Colonial Alloys Co., Philadelphia, Pa. 19
Turco Products, Inc., Los Angeles, Cal. 12

U

Udylite Corp., The, Detroit, Mich. 23
United Chromium, Inc., New York. 17
United Platers, Inc., Detroit, Mich. 34
U. S. Galvanizing & Pltg. Equipment Corp., Brooklyn, N. Y. 28

V

Vonnegut Moulder Corp., Indianapolis, Ind. .. 263
Vulcan Detinning Co., The, Sewaren, N. J. 239

W

Waterbury Rolling Mills, Inc., Waterbury, Conn. 239
Whittaker, Clark & Daniels, Inc., New York, N. Y. 18
Wyandotte Chemical Corp., Wyandotte, Mich. 21

Z

Zapon Division, Atlas Powder Co., New York and Stamford, Conn., & North Chicago, Ill. 242
Zialite Corp., Worcester, Mass. 238

ROBERTS

BUFFING and BURRING COMPOUNDS ASSURE

The Best Quality, Correct and Uniformly controlled manufacturing, Fair Price Policy, and Special Formulas for Individual Demands.

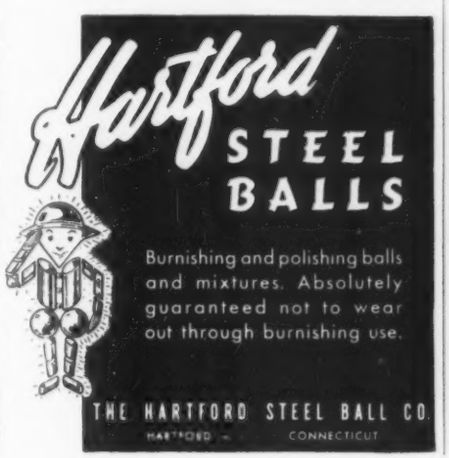
WE PRODUCE

BURRING COMPOUNDS ..... All types
ROUGES (Iron Oxides) (Quick wash) All grades
TRIPOLI ..... Numerous grades
EMERY PASTE ..... All size grains
COMPOUNDS ..... For every metal
GREASE STICKS ... For better efficiency
LIME COMPOUNDS ..... Many formulas

—Let us send you some free samples—

The ROBERTS ROUGE COMPANY

STRATFORD CONNECTICUT


Hartford
STEEL
BALLS
Burnishing and polishing balls and mixtures. Absolutely guaranteed not to wear out through burnishing use.
THE HARTFORD STEEL BALL CO.
HARTFORD CONNECTICUT

Established 1901

ORIENTAL ROUGE CO., INC.

66-68 PINE STREET, BRIDGEPORT, CONN.

ALUMINUM: cutting and coloring compounds.

STAINLESS STEEL: a complete line of cutting and coloring compositions.

STERLING and SILVER PLATE: Rouges to fit your particular job.

We invite your inquiry.

ELECTROPLATING ENGINEER

Graduate chemical engineer and metallurgist, 10 years of experience in metal finishing industry, plating all metals, patents, outstanding industrial developments; many published papers, desires production or development and research connection with a Top Flight Concern.

Address E.P.E. 5, care Metal Finishing.

RESEARCH ELECTRO-CHEMIST

Many years experience in the field of electrodeposition from all solutions both on metallic and non-metallic surfaces is desirous of a suitable connection as a consultant with a progressive firm on a part-time basis. Specialization on non-metallics such as plastics and lead plating.

Address Electro-Chemist, care of Metal Finishing, 11 W. 42nd St., New York.

American Electroplaters' Society

31st ANNUAL CONVENTION

BUFFALO, N. Y. • HOTEL STATLER

June 7, 8, 9, 1943

PROGRAM

MONDAY
Organic Finishing
5 papers planned

TUES. P. M.
Hard Chromium
4 papers planned

TUES. A. M.
Burring
4 papers planned

WED. P. M.
Plating
5 papers planned

WED. A. M.
Cleaning
4 papers planned

Tin, Silver, Black, Magnesium, Anodizing

ANNUAL BANQUETS

MILWAUKEE BRANCH

Milwaukee Branch, A. E. S., will hold its Annual Educational Meeting and Banquet at the Schroeder Hotel, Milwaukee, on Saturday, April 24th. The Educational Session is scheduled for 2 p. m. in the Pere Marquette Room and will include papers by Messrs. Lewis, Pinner and Soderberg. The Banquet will begin at 7 p. m. in the Crystal Ball Room. Music and entertainment will follow. Admission is $3.50 per plate and tickets and further information may be obtained from James Durnford, 2370 North 32nd Street, Milwaukee, Wis.

NEW ENGLAND REGIONAL

New England Regional Session and Banquet will be held May 1st at the Hotel Bond, Hartford, Conn. For further information write Arthur W. Logozzo, care of Hartford Chrome Corp., 525 Park St., Hartford, Conn.

NEWARK BRANCH

Newark Branch, A. E. S., will hold its Annual Educational Session including pictures and a speaker in the ballroom of the Robert Treat Hotel in Newark on May 1st. Refreshments will be served and details can be obtained from George Wagner, 1130 So. Long Avenue, Hillside, N. J.

ODDS and ENDS

Now that the Ides of March are gone but not forgotten and settlement has been arranged with Mr. Morgenthau, we have found time to wonder about a few things, especially about what has become of *salesmen*. Lately we have been meeting sales engineers, field engineers, service engineers, technical representatives and service representatives, but the plain ordinary salesman seems to have disappeared. It might be a good idea to shoot and stuff a member of this almost extinct species of fauna so that future generations will be enabled to study him.

And while we are on the subject of study—

A reader with a pH set might be interested in checking the results given in a paper with the following title: "*The Effect of pH on the Formation of Pyrrolidonecarboxylic Acid and Glucamic Acid During Enzymatic Hydrolysis of Glutathione by Rat Kidney Extract.*" And if you don't believe it, the article will be found in the Journal of Biological Chemistry, **145,** 471 (1942).

Statistical Section: The shellac that goes into the preparation of six phonograph records will waterproof the primer cups of 100,000 rounds of .30 caliber cartridges—and a million pounds of paint were used on the 45,000 ton battleship Iowa.

And in case platers are still wondering why on earth a metal as plentiful as zinc should be on the restricted list, we offer herewith the very interesting statistic to the effect that about 18,000 pounds of zinc are used on a single Liberty Ship just for the propeller. It adds up, gentle readers!!

What We Learn From the Ads: A carbon brush manufacturer boasts that he can supply "*Everything in Carbon but Diamonds*". And a wire brush producer states that one of his brushes, 1½" in diameter and 2" long, is made with 242,144 points. We demand a recount!!

We not only read the ads but also find time occasionally for perusal of other copy. In discussing lead production last month, *The New York Times* spoke of the Metals *Preserve* Company. Perhaps they also meant *Sugar of Lead*. Some other slips we've come across in plating circles are reverse current *itch*, *prudential* difference, cooling *cowl* and cathode *deficiency*. The last doesn't sound bad if you say it fast enough.

The word *Sterling*, according to our dictionary, denotes *genuine* or *pure*, and probably comes from *Easterling* which was once the popular name of German traders in England whose money was of the purest quality; yet sterling silver contains 7½ per cent copper.

And as the burglar said when the lady of the house caught him stealing her silverware, "I am at your service, ma'am".

Slogan of the Month: You Can Always Live on Less When You Have More to Live For. . . . Buy War Bonds.

The United States needs war materials faster and they are getting them! New methods are being used that will double our war production — New cleaning compounds have been developed that do away with lost time, save metals and manpower — you started this war, Mr. Schicklgruber, but these compounds will help finish it!

NEW COMPOUNDS FOR CLEANING METALS ARE FAST, EFFICIENT AND ECONOMICAL TO USE

Learn the difference between these new, improved compounds for cleaning and your present method. You'll be amazed at the difference specialization can make — how it saves time and reduces costs. You will find a special MacDermid compound developed for your particular problem that actually blasts inorganic dirts from basis metals. See for yourself — test and compare in your own plant, on our guarantee, by writing directly to us for a qualified service engineer to call at your convenience.

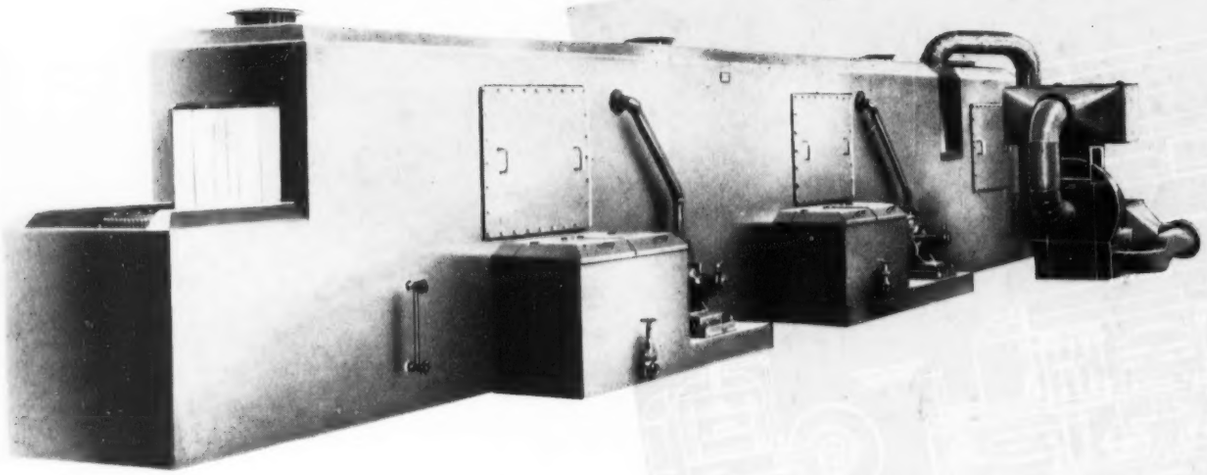
FOR REMOVAL OF PHENOLIC LACQUERS FROM STEEL SHELL CASES

MacDermid has developed a new, amazingly simple method for stripping phenolic lacquers that is already being recommended by many industrial plants as the fastest, most positive means for removing scratched or improperly applied lacquers baked on to steel shell cases. This process employs a low concentration alkali operating at, or near, boiling point into which shell cases are dipped for a short time, rinsed and then again dipped in a non-proprietary solution thereby restoring them to their original status and protecting them from rust until parts can again be lacquered.

WRITE FOR *Free* DATA SHEETS

SALES AND SERVICE
from
COAST TO COAST
New York Cleveland Los Angeles
Chicago Detroit St. Louis
Newark Philadelphia
Toronto, Canada

MAC DERMID
INCORPORATED
WATERBURY, CONNECTICUT

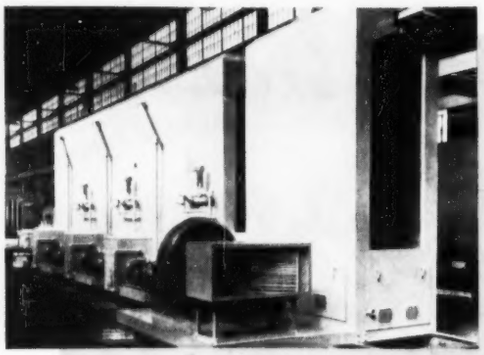


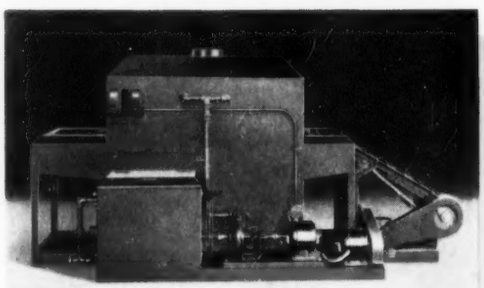
TO MEET *Your* METAL CLEANING NEED

Detrex Washers—using alkali cleaning compounds, petroleum spirits or emulsion cleaners—are engineered to the customer's need. Incorporated is every detail which can contribute to long life and high efficiency.

Among the features of Detrex Washers are heavy, reinforced construction; balanced heat input; fully effective drying equipment, and proper directional spraying. Large access doors permit easy inspection, cleaning and adjustment of spray nozzles. Each washer with self-contained conveyor is equipped with variable speed drive. Conveyors used include monorail, slat belt and roller types.

Various models of Detrex Washers are pictured and described in the new catalog—"Detrex Metal Parts Washers". Write for your copy.





CLEANING ENGINEERS
DETREX
DETROIT REX PRODUCTS

SOLVENT DEGREASING and ALKALI CLEANING

DETROIT REX PRODUCTS COMPANY

13000 HILLVIEW AVENUE • DETROIT, MICHIGAN

Branch Offices in Principal Cities of U. S. A. — In Canada: Canadian Hanovia & Von Ormble Co., Ltd., Toronto, Ontario